PB89-224075

Waste Audit Study: Automotive Paint Shops

SCS Engineers, Inc., Long Beach, CA

Prepared for:

California Dept. of Health Services, Sacramento

Jan 87

U.S. Department of Commerce
National Technical Information Service
NTIS

PB89-224075

WASTE AUDIT STUDY

AUTOMOTIVE PAINT SHOPS

PREPARED FOR

ALTERNATIVE TECHNOLOGY SECTION
TOXIC SUBSTANCES CONTROL DIVISION
CALIFORNIA DEPARTMENT OF
HEALTH SERVICES

PREPARED BY

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.

JANUARY 1987

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

50272-101

REPORT DOCUMENTATION PAGE

1. REPORT NO. 005-005

2.

3. Recipient's Accession No. PB89 224075/AS

4. Title and Subtitle
Waste Audit Study of Automotive Paint Shops

5. Report Date
January 1987

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
SCS Engineers, Inc.
4014 Long Beach Boulevard
Long Beach, California 90807

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
California Department of Health Services
Alternative Technology and Policy Development Section
744 P Street
Sacramento, CA 95814

13. Type of Report & Period Covered

14.

15. Supplementary Notes
This document is included in the Pollution Prevention Information Clearinghouse, operated by Science Applications International Corporation (SAIC) for the U.S. EPA, at 8400 Westpark Drive, McLean, Virginia 22102.

16. Abstract (Limit: 200 words)

This report presents the results of a waste audit study of automotive paint shops. The study focuses on the types and quantities of wastes generated, treatment and disposal alternatives, and the potential for reducing the amount and/or toxicity of waste generated. The analysis of solvent waste minimization focused primarily on in-plant modifications (e.g., source reduction) to reduce the generation of solvent waste. Strict inventory control is the most readily implementable approach. While in-house recycling is viable, it is usually only cost-effective for larger firms. Specific recommendations for waste reduction were made.

17. Document Analysis a. Descriptors
pollution prevention, waste minimization

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement
release unlimited

19. Security Class (This Report)

20. Security Class (This Page)

21. No. of Pages 108

22. Price

(See ANSI-Z39.18)

See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

WASTE AUDIT STUDY:
AUTOMOTIVE PAINT SHOPS

Prepared by:

SCS Engineers, Inc.
4014 Long Beach Boulevard
Long Beach, California 90807
(213) 426-9544

Prepared for:

California Department of Health Services
Alternative Technology and Policy Development Section
744 P Street
Sacramento, California 95814

January 1987

File No. 18626

CONTENTS

Chapter Page

Abstract
Acknowledgements
Disclaimer
Contracts

1 Summary and Conclusions....1

2 Recommendations....3

3 Introduction....4

4 Industry Profile....7

5 Source Reduction....14

6 Recycling and Resource Recovery....17

7 Principal Treatment Alternatives....20

8 Economics....24

9 Summary of Facility Audits....27

10 Self-Audits....42

Bibliography....61

Appendices

A Waste Audit Questionnaire

B Completed Waste Audit Questionnaires

ABSTRACT

This report presents the results of SCS's Waste Audit Study of Automotive Paint Shops. The focus of the study is on the types and quantities of wastes generated, treatment and disposal alternatives, and the potential for reducing the amount and/or toxicity of waste generated.

Several tasks were performed for this study, including: (1) field audits of six automotive paint shops in Southern California; (2) review of current waste management methods and technologies; (3) characterization of source reduction alternatives for minimizing solvent waste; (4) characterization of on-site and off-site solvent recycling alternatives; and (5) characterization of treatment alternatives.

The analysis of solvent waste minimization focuses primarily on in-plant modifications (e.g., source reduction) that could be implemented to reduce the generation of solvent waste. Strict inventory control is the most readily implementable approach. Some waste products can be reused in-house where material specifications are less demanding. In-house recycling is a viable option, but is usually only cost-effective for larger firms.

On-site treatment is generally not a viable option for this industry segment. The amounts of waste generated do not justify the costs associated with treatment technologies.

Facilities selected for this study were not necessarily intended to represent the automotive services industry. Only companies having well managed waste practices were willing participants. This is in accordance with the study objective which is to present proper waste management activities and recommendations which can be used as a model and guide for that industry.

ACKNOWLEDGEMENTS

SCS Engineers would like to acknowledge the efforts of those individuals who contributed to the development of this report. In particular, we wish to thank Benjamin Fries, David Leu, Kim Wilhelm, Jan Radimsky, and James Potter of the Alternative Technology and Policy Development Section at the California Department of Health Services; Deborah Hanlon of the County of Ventura; Mrs. Moonyean Kistler of the Automotive Service Councils; the owners of the shops that participated in this study; and finally J. Rodney Marsh, Julio Nuno, Carol Votaw, and SCS's production staff for their fine efforts in the production of this report.

This report was submitted in fulfillment of Contract No. 85-87159 by SCS Engineers under the auspices of the California Department of Health Services. Work for this Final Report was completed as of January 31, 1987.

DISCLAIMER

The statements and conclusions of this report are those of the Contractor and not necessarily those of the State of California. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

CONTRACTS

Contract No. 85-87159 provided $25,000 to prepare this report. No subcontractors were involved in the preparation.

CHAPTER 1

SUMMARY AND CONCLUSIONS

SUMMARY

Hazardous waste audits were performed at six companies from the automotive paint and body industry. These audits involved visits to the candidate facilities with the intent of identifying hazardous wastes generated, current management practices, and deficiencies, if any, in hazardous waste practices. These data, in turn, were used to characterize the industry and to provide a basis for recommendations to improve waste handling both for the audited companies and the industry as a whole.

Based on data for the audited companies, the average automotive painting facility has seven employees and paints all or part of 600 cars annually. Most shops do exclusively body repair and painting; a few shops do mechanical work as well. The average shop uses about 360 gallons of solvents and thinners annually and generates about 240 gallons of mixed wastes (solvent, thinner, paint, hardeners, catalysts, and reducers). Shops involved in mechanical repair generate 100 gallons of motor oil and 50 gallons of other engine fluids annually. In addition, shop floor washdowns typically contain small quantities of radiator and engine fluids from collision-damaged automobiles. Washdown wastewater is generally discharged either directly to sewer systems or to clarifiers/separators and then to sewer systems.

All of the companies audited recycle thinners and waste oils, a distinct improvement over practices observed in a similar study conducted 5 years ago. Most thinner recycling is done through the paint/solvent suppliers and is part of the purchase price of the solvent. One company recycles on site. In general, hazardous wastes are stored on site until a drum is filled. This usually takes longer than the 90-day period permitted by the regulations.

Inventory control is an inexpensive and effective way to reduce solvent use and waste generation, but is often practiced only sporadically. Conventional waste treatment methods, while applicable to most of the wastes generated by this industry, are generally not implementable by individual small businesses.

Additionally, as long as there is a viable recycling industry, there appears to be little need for waste treatment on a large scale.

In general, the waste audit proceeded smoothly. Shop owners, managers, and employees were largely cooperative. A waste audit questionnaire prepared prior to the audits proved to be an effective means of ensuring that all relevant data were gathered during one visit.

CONCLUSIONS

- The waste audit is a useful approach for evaluating hazardous waste management and identifying deficiencies in the automotive painting industry.
- The approach adopted in this study is a viable audit approach for this industry group.
- The majority of the wastes produced by this industry group are recyclable.
- Recyclable thinners are amenable to in-house recycling, but the process is cost-effective only for larger facilities.
- Strict inventory control is an important method for reducing thinner use and waste thinner generation.
- Waste treatment technologies are generally not implementable by individual small businesses.

CHAPTER 2

RECOMMENDATIONS

The recommendations suggested in this section relate generally to the automotive paint and body industry as a whole. Specific recommendations for the six companies audited are provided in Section 9.

SOURCE REDUCTION

- Vehicles received at the facilities should be examined for leaking engine parts. Drip pans should be placed under these leaks to avoid spills on the floor which tend to be washed into drains.
- Rigid inventory control should be implemented to as great a degree as possible. Such practices tend to reduce thinner use and waste generation.

RECYCLING

- All waste solvents/thinners and oils should be recycled.
- Large companies should consider installing in-house recycling equipment.
- Excess paint should be given to the customer for use in touch-ups, rather than added to the waste solvent drum.

REGULATORY GUIDANCE

- More effort should be directed toward educating the facility owners/managers in the pertinent aspects of hazardous waste regulations, particularly those affecting manifesting and on-site storage.

CHAPTER 3

INTRODUCTION

BACKGROUND

Land disposal of many hazardous wastes is being phased out in California. As a result, it is necessary to implement alternative technologies to treat, reduce, or eliminate hazardous wastes which have been subject to land disposal until recently. One of the approaches under consideration by the California Department of Health Services (DHS) is hazardous waste reduction. For the purposes of this report, waste reduction is defined as any method or process which reduces land disposal activities. It includes source reduction, recycling, and treatment.

Hazardous waste reduction is beneficial both for the economic well-being of the affected industries and for the environment. As part of their effort, DHS is placing emphasis on small businesses which often lack both an awareness of hazardous waste management issues and the technical expertise to address them. As part of that program, DHS plans to provide technical assistance to help California industries improve management of hazardous wastes. An important feature of this program is the waste audit study.

This waste audit study is one of several initiated by DHS to recommend a waste audit format and to address waste management options for a particular industry. This study focuses on the automobile paint and body industry.

A hazardous waste audit is a systematic and objective review of a facility's operations and practices related to meeting hazardous waste management regulations. Audits can serve to evaluate the effectiveness of waste management systems already in place or to identify deficiencies.

APPROACH

In general, the project involved the selection of six automotive paint and body companies, shop tours, data collection, data analysis, preparation of hazardous waste audits, and preparation of the final report.

Selection of the auto painting companies was performed in two stages. In the first stage, a list of potentially interested hazardous waste audit participants was compiled by contacting the Automotive Service Councils. The list included 14 automotive painting companies, located in the Los Angeles area, which expressed a willingness to participate in a study of this nature. Initial contacts were made with most of the candidate companies. The companies that were reluctant to participate, or those who would not return repeated phone calls, were systematically disqualified. Most of the remaining companies were not only willing but were often eager to participate in the audits. Firms exhibiting a cooperative attitude toward hazardous waste management are more likely to exhibit good waste management practices; auditing them would produce information useful in developing recommendations and a model audit that promotes good waste management. Therefore, no special effort was made to audit firms which might practice poor waste management.

In the second stage, six companies were chosen for the actual audits. The companies selected included paint operations of varying sizes representing a wide spectrum of disposal patterns. An attempt was made to select shops which would present the greatest variety in terms of size, chemicals used, waste management, location, and volume of business.

Shop visits were conducted to become familiar with the physical plants and to collect data. An initial comprehensive interview with the owner or manager was conducted to determine the shop's general operating characteristics, size, services offered, material utilized, types and quantities of waste generated, and current management practices. Following this interview, the shop was toured with the owner or manager during business hours to ensure that normal waste-generating practices were taking place.

A second visit to the shop, which had been part of the original plan, was later deemed unnecessary. Data acquired during the first visits were adequate for the purposes of the study, and waste stream sampling, analysis, and flow measurements were not necessary for this industry. The waste streams encountered were all easily identifiable and quantifiable.

Data analysis was performed both on an individual shop basis and for the industry group as a whole. The data for each shop were analyzed with the intent of identifying deficiencies and recommending changes in processes, chemicals used, or waste management practices to achieve reductions in waste generation. Aggregated data were used for the purposes of preparing an industry profile, both in terms of wastes generated and industrial processes. Data from other studies, which included automotive painting companies, were used to create a much larger and more valid data base upon which to make further recommendations. As a result, the descriptions of the industry and its wastes are based on dozens of companies rather than on the six companies visited in the course of this project alone. Using this overall data base, various source reduction, recycling/resource recovery, and treatment alternatives available to this industry group were identified and evaluated.

Based on the data collected, audit reports were prepared for each company. The reports provide a brief overview of shop operations, services rendered, types and quantities of materials used, types and quantities of wastes generated, and current disposal practices. Where current waste handling practices are not in accordance with applicable regulations, these deficiencies are noted and changes recommended to ensure future compliance. The audits discuss the types of waste management options available to each company, with advantages and disadvantages of each. Costs and potential pay-backs to the company are discussed for each alternative.

REPORT ORGANIZATION

Chapter 4 of this report profiles the automotive painting industry as a whole. The industry is described along with typical chemical use and waste generation. The profile includes data from this study and other related studies.

Chapters 5, 6, 7, and 8 discuss various aspects of hazardous waste management as they apply to this industry group. Chapter 5 deals with source reduction and techniques to minimize waste generation. Chapter 6 looks at recycling and resource recovery, discussing the types of waste that could be recycled and the in-house and off-site recycling processes and services available. Chapter 7 discusses the principal treatment alternatives that might be applicable to the generated waste streams. Chapter 8 deals with the economics of viable management alternatives.

Chapter 9 summarizes the basic audit procedure used in this study and the six individual company audits. Chapter 10 discusses self-audits; an owner- or manager-conducted audit procedure and guidelines are discussed.

CHAPTER 4

INDUSTRY PROFILE

DESCRIPTION OF INDUSTRY

The specific companies audited in this study were selected from the industry classifications which include top and body shops and paint shops (SIC 7531 and 7535). The establishments in this industry are engaged in general automotive and body repair with particular focus on collision repair and painting. These shops are distributed throughout the state. The heaviest concentrations are near urban centers and in industrial areas.

The majority of these establishments are small in size with an average of 7 employees. Of the 6 audited companies, 1 had less than 5 employees, 3 had between 5 and 10 employees, and 2 had over 10 employees. In a previous study conducted by SCS Engineers (1982), automotive paint and body shops were included as part of a larger small-quantity hazardous waste generator study. Of the 24 companies representing this industry, 17 had between 1 and 10 employees; the remaining 7 had between 11 and 25 employees.

The automotive paint and body industry can be divided into two distinct subsets. The first consists of shops that work only on collision repair, frame and front-end adjustments, and body painting. These companies generate paint-associated hazardous wastes almost entirely. These wastes include toxic and ignitable thinners, toxic paint wastes, paint sludges and oil- and solvent-contaminated rags, empty cans with paint and thinner residues, and contaminated paint booth filters.

The second group of shops do mechanical work as well as collision repair. In addition to the above-noted wastes, these shops produce hazardous waste streams which include waste oils, oil filters, engine/hydraulic fluids, antifreeze, and corrosive wastes from lead batteries. Very few automotive paint and body shops conduct mechanical work in conjunction with collision repair.

WASTE GENERATION

To perform collision repair, body shops use a wide range of equipment, chemicals, and raw materials. Available services include welding, filling dents with plastics or fiberglass, body section adjustments, alignments, and painting.

Body repair work cannot be performed without the use of welding equipment such as blow torches. This equipment is used extensively in body shops and has various uses, including welding, cutting, and heating to shrink and expand metals, to forge or shape metal, and to solder. A welding and cutting job requires equipment such as an oxygen cylinder, acetylene cylinder, welding torch, regulators, and steel filler rods. The flame produced when the two gases are mixed together is hot enough to melt, bond, and repair most commercial metals. With the exception of pressurized gases, little or no chemical usage is associated with this process. Consequently, no hazardous wastes are produced.

To repair both minor and major auto body damage, hydraulic equipment and hand tools are used to restore damaged sections, assemblies, and parts to their original positions and shapes. Equipment such as jacks and lifts generates enormous pulling and pushing capacities. These heavy machines can straighten bent frames, align hoods and fenders, and adjust panels. Oil is essential to the proper operation of these machines. Regular fluid changes and repair to equipment generate negligible amounts of spent fluids, which are recycled with other waste oil generated on site.

When dented, some areas on an automobile body are not accessible for repair with the use of hydraulic equipment. These areas can be repaired with plastic or fiberglass body filling. These are used by adding a hardener or catalyst to the filler material and layering it in the area of the dent. The material, which is mixed on a glass or steel plate, is applied to the damaged area. To reduce generation of residual waste materials, a conservative quantity of material is mixed. Once the dent has been completely filled, the excess dried material is sanded down flush with the rest of the body. This process does not generate extra material, because the entire quantity that is mixed is applied to the dented areas. The major residual waste generated is fiberglass and plastic dust which collects on the floor during sanding operations. This material is collected and deposited into refuse dumpsters. Minor quantities are rinsed into drains during routine washdowns.

The largest amounts of hazardous waste are generated from service and painting operations. Services conducted in conjunction with body repair can include oil changes, fluid replenishment, and radiator repairs. These activities generate hazardous wastes such as waste oil, oil filters, engine and hydraulic fluids, wastes from radiator flushings, used batteries, and contaminated rags.

Paint operations generate the largest volume of hazardous wastes for this industry through the use of chemicals such as paint thinners and reducers, and the paint itself. Paint is sprayed under pressure onto automobile surfaces via a medium of paint thinner. Once the paint is applied, the thinner evaporates and the paint dries and hardens. A significant portion of the product evaporates during the painting process, resulting in less waste generated than product used. This accounts for the large discrepancy between the amounts of raw material thinner purchased and the amount of waste thinner generated. In addition to use as a carrier for applied paint, paint thinner is also used as a solvent to clean equipment.

According to a study conducted by TRW (1979), the total amount of hazardous waste generated by the targeted industry throughout the nation was estimated to be 1.8 million pounds per month (820,000 kilograms per month), with an average generation rate of 77 pounds per month (35 kilograms per month) per generator. This figure, however, also includes wastes generated by the tire retreading and repair shops (SIC 7534). Therefore, the generation rate would be somewhat lower, because rubber/tire wastes and toxic flue wastes would not be included.

Waste thinner generation rates from data collected by SCS Engineers (1982) range between 0.8 and 200 gallons per month. Monthly waste generation rates for the audited companies, shown in Table 4-1, range between 5 and 37 gallons per month.

WASTE RECYCLING

Excess paint, paint sludge, and thinner mixtures are poured into 55-gallon drums or other containers for storage. The paint sludges and solids settle to the bottom, leaving a liquid layer of thinners on the top. The waste drum is subsequently removed by a hauler to a reclamation or disposal facility.

With the exception of one company which reclaims wastes on site, all of the audited companies utilize the services of a reclamation facility for the removal of wastes. This service is part of a turnkey operation provided by the paint and thinner supplier. The purchase of chemicals includes the cost of delivery, waste hauling, recycling, and disposal. The service removes the wastes at the same time that it delivers the new product. The service will remove the supernatant from the waste drum using a pump truck (with sludge removed on a less frequent basis), or will haul the entire drum away. The waste is hauled to a licensed treatment, storage, and disposal (TSD) facility for reclamation. The service collects from a number of small-quantity hazardous waste generators in a given area. This renders reclamation economically feasible for this industrial segment. The owner does not have to contract for purchase and disposal separately.

TABLE 4-1. MONTHLY HAZARDOUS WASTE GENERATION FOR AUDITED COMPANIES

Company	No. Employed	Business Volume (No. Cars)	Thinner/ Paint Sludge (gal)*	Empty Paint Cans	Trans. Fluid (gal)	Hydraulic Fluid (gal)	Anti-Freeze (gal)	Oil (gal)
A	6	50-75	5	5-7	0	0	0	6
B	13	100	37	5-10	0	0	0	0
C	13	55	20	20-30	2	2	8	7
D	9	30-40	30	25-35	0	0	0	0
E	7	30	17	25-30	0	0	1-2	14
F	3	25	5	25	0	0	0	0

* Thinner/paint sludge also includes additives of hardeners, catalysts, and reducers.

The one company that did not use an off-site treatment service had recently installed on-site recycling equipment for thinner and paint wastes. This alternative is better suited to the large companies, however, since the initial capital expenditure is rather high. The use of waste recycling and treatment facilities has eliminated most waste disposal problems, and helps reduce the possibility of waste release to the environment.

Other studies suggest that the use of recycling in this industry has not been typical in the past. In a study conducted by SCS Engineers (1982) in which all companies in a limited area were contacted, most companies in the automotive paint and body industry were disposing of wastes with conventional refuse, pouring wastes on soil, or allowing wastes to evaporate. Three of the 24 companies surveyed were recycling wastes. However, this practice was limited to waste oils.

Several reasons can be suggested for the discrepancy between the data for this audit and previous data. These are:

- Selection of a more knowledgeable segment of the auto body service industry for audits due to their affiliation with the California Automotive Service Councils (ASC).
- A greater awareness of applicable hazardous waste regulations in general by this industry.
- Lower cost and better availability of recycling services.
- Greater awareness of recycling options and financial advantages on the part of the suppliers.

WASTE STORAGE

The industry uses basically two methods of chemical and hazardous waste storage. In some shops, all of the thinners, new chemicals, and wastes are stored together in a designated covered area. The drums are placed on asphalt, concrete, or steel floors. The remaining shops store their drums indoors, but scatter them around the shop at the points of highest use.

In some studies, improper storage and soil contamination have been noted as being indigenous to the automotive painting and body repair business (SCS Engineers, 1982). No evidence of drum storage outdoors or on open soil was observed during the audits. This greatly reduces the potential for accidental or intended soil contamination. While none of the shops visited used drum cradles or stands, all of the companies used some type of spigot or pump as well as lids to reduce product spillage and evaporation. All companies participating in the hazardous waste audit had an average of between two and seven drums containing chemicals and/or hazardous wastes on site.

Although most of the contacts interviewed expressed a willingness to operate within industry regulations set by the state, hazardous waste storage ceilings were often ignored or unknown. Most of the smaller operators use waste inventory as a means of determining when to call their recycler. In the smaller shops, however, it often takes up to 6 months to fill a 55-gallon drum with waste thinners and paints.

Although a 90-day limit for storage of hazardous wastes is imposed under current hazardous waste regulations, the time period for calculating the 90-day limit for generators of less than 100 kilograms per month begins when 100 kilograms of hazardous waste are accumulated. If more than 100 kilograms are generated in any calendar month, the time period begins when any amount of waste begins to accumulate. With the exception of one shop, all audited operations generated less than 100 kilograms of hazardous waste per month. Waste storage for up to or beyond 90 days must meet federal, state, and sometimes local regulations.

WASTE DISPOSAL

Several studies have cited prevalent disposal practices within the industry. These include waste thinners being discharged into the sewer or disposed of on open ground, and paint cans and filters being disposed of in on-site solid waste dumpsters (SCS Engineers, 1982). During the course of our audits, there was no evidence of large-quantity thinner discharges into the sewer or onto open ground. One shop owner admitted to pouring waste oil along one side of his facility as a means of weed control; however, he discontinued this practice some years ago when the DHS warned him of the associated hazards.

During the interviews the largest potential for waste disposal mismanagement was found in the handling of paint cans with associated residues, paint equipment filters, oil filters, and small amounts of engine fluids. Almost without exception, the cans and filters were disposed of in on-site refuse dumpsters, to be removed during weekly municipal waste collections. When small amounts of engine fluid were generated, they were allowed to drain onto the floor. These include anti-freeze from damaged radiators, brake fluids, transmission fluids, etc. The residues were then either absorbed with a type of floor drying agent which was subsequently disposed of in the dumpster, or rinsed down drains or sewers without prior treatment during routine washdowns.

Due predominantly to economic reasons and ease of operation, none of the establishments visited used landfills for disposal of waste paint, thinner, and reducer. All of the audited facilities utilized waste recycling, as discussed earlier.

WASTE MANAGEMENT

In a previous study done by SCS Engineers (1982) as part of a small-quantity hazardous waste generator study, data were gathered from the auto body industry to determine the amount of money that individual companies would budget for hazardous waste management. At the time of the 1982 study, no company was spending in excess of 0 to 5 percent of its budget on hazardous waste management. Although most expressed the desire to avoid penalties associated with hazardous waste storage and removal, few were willing to absorb the extra costs involved. Our interviews showed that most operators thought the laws governing their industry to be confusing and ambiguous. It was the consensus of the operators that regulatory language needs to be simplified, and that industry updates should be distributed on an annual basis.

CHAPTER 5

SOURCE REDUCTION

Source reduction involves waste management strategies which prevent waste from being generated or which segregate wastes for recycling. Recognizing that source reduction is as much an operations term as it is a pollution control term, many industries have reduced hazardous waste at its source simply by not generating it. Many hazardous materials which were routinely discarded in the past are receiving much more attention because of changing market and environmental constraints. Although many companies have discovered that they can reduce costs by reducing wastes, it is often difficult to change procedures that have been developed through years of corporate policy.

There are several potential waste reduction alternatives applicable to the auto body and painting industry. These include rigid inventory control, housekeeping operations to reduce leaks and spills, equipment changes, and product substitution.

Rigid inventory control, though time-consuming, provides a very effective means of source reduction at virtually no cost to the operator. This alternative can be implemented in several ways. The owner may monitor employee operations and make verbal or written comments on product usage and suggested limits. In larger shops where monitoring of employees is not a viable alternative, the owner or manager can limit access to storage areas containing raw materials. This inaccessibility forces the employee to stretch the use of raw materials farther. Moreover, through this practice, the owner/manager can monitor the use of raw materials.

Basic housekeeping techniques can be very effective as a means of source reduction. There are a variety of methods available to control and minimize leaks which can be implemented easily at no cost to the operator. Specific approaches to drum location, product transfer methods, leak collection, and drum transport can effectively limit product loss.

There are two predominant patterns of drum location. If inventory control is necessary to minimize product usage, drums should be stored together in an area of limited accessibility, such as indoor/outdoor sheds, flammable lockers, or locking storage rooms. If employees take individual responsibility for regulating product use and if inventory control is not a problem, it may be more effective to separate drums and place them at points of highest use in the facility. This alternative reduces the chance of product leaks and spills during transport from storage to work areas.

The potential for accidental spills and leaks is highest at the point of product transfer of thinners and oils from bulk drum storage to process equipment. Spigots or pumps should always be utilized when dispensing new materials, and funnels should be used to transfer waste materials to storage containers. Material should never be poured directly from drums to smaller containers.

Evaporation is a material loss that can be controlled through the use of tight-fitting lids, spigots, and other appurtenant equipment. The reduction of evaporation will increase the amount of available material and result in lower solvent purchase cost.

If drum transport or movement is necessary, it is essential that drums be moved correctly to preserve the integrity of the containers and to prevent damage or punctures. Drums should be lifted by means of powered equipment or hand trucks. Under no circumstances should drums be tipped or rolled, even when empty. Negligent transport procedures will cause drum damage, particularly to seams, which could lead to leaks or ruptures during future use.

Upon arrival at paint and body shops, many collision-damaged vehicles are leaking engine fluids such as antifreeze, engine oils, and hydraulic/brake fluid. All damaged vehicles should be evaluated for leaks before entering the facility. When leaks are detected, drip pans should be placed under the vehicle to prevent drainage onto floors and into drains. This procedure is particularly important at those facilities that routinely hose down work areas into floor drains which empty to the sanitary sewer.

Once vehicle painting operations are completed, residual amounts of dye-matched paints are disposed of in semi-filled cans or poured into waste collection drums. Giving extra paint to customers for touch-up use reduces storage of paint wastes and the incidence of improper disposal of waste paint cans with nonhazardous refuse. It would also promote customer good will. By not adding paint residues to thinner wastes, thinner purity remains higher, which would increase its potential for resource recovery and reuse.

Another method of source reduction is the substitution or alteration of equipment. However, because equipment suppliers have standardized most tools of the auto paint industry, variations on equipment which would decrease product use are not readily available. Standard paint sprayers consist of two main units: the spray gun assembly and the paint cup. Paint cups in use can contain up to a quart of paint. For collision repair work, auto painting operations generally only include spot painting of the damaged area. Most small cars can be painted entirely with one quart of paint; touch-ups and damage repair would use substantially less than one quart. Availability of variously graded sizes of paint sprayer cups would enable operators to use the equipment best suited to the size of a particular job. Varying paint cup sizes could be an effective means of source reduction in two important ways. It would limit overmixing of paint to be used on a specific project, and decrease the amount of solvent needed for equipment cleanup when doing spot painting and small jobs.

Product substitution of water-based paints for solvent-based paints which use toxic metal pigments has been important to many paint-associated industries. This substitution has been mandated for some uses in areas of California due to concern over air pollution associated with the solvent base. However, associated products have not yet extended to the auto paint industry; as such, product substitution does not provide a viable alternative at this time. Currently, no specific recycling technique has been identified for water-based paint sludge, while the solvent-based paint sludges can often be recycled. Spills and spoiled batches may often be reworked into usable products rather than disposed of in landfills.

CHAPTER 6

RECYCLING AND RESOURCE RECOVERY

The majority of waste products generated by the auto body and painting industry are reusable or recyclable. These wastes include paint and thinner wastes, used oil, car batteries, and soiled rags. Paints used in this industry contain pigments which are compounds of cadmium, chromium, zinc, and lead. Contaminated thinner containing paint sludge is generated from paint operations as a result of equipment cleanup, spills, off-spec paints, and excess paint.

Sludges from drum cleanup and thinner recovery from solvent-based paints contain as much as 50 percent organic thinners such as hydrocarbons, ketones, esters, and alcohols, and about 5 percent inorganic pigments. It has been estimated that 1 gallon of sludge is generated for every 120 gallons of solvent-based paint product used (Stoddard, 1981).

Processes for recycling thinners are well established and widely used. All 14 companies contacted in the preliminary interviews used some form of on-site or off-site thinner reclamation. Small generators and those generators who do not possess the technical expertise, or find it uneconomical to recycle contaminated thinners on site, usually send thinner wastes to commercial recyclers for recovery. Commercial recyclers have versatile distillation processes and can handle large volumes and varieties of thinners. Generally, thinner recyclers can reprocess 70 to 80 percent of the incoming spent thinners into reusable products (Stoddard, 1981). Reclaimed thinners are often sold back to the generators after the thinners are reconstituted.

Several alternatives are available to operators who wish to conduct some or all of their resource recovery and recycling processes on site. Gravity separation is an inexpensive form of resource recovery that is relatively easy to implement. This form of reclamation can be effected by allowing the thinner/sludge mixture to separate under quiescent conditions. The supernatant can be decanted using a drum pump and a float valve to retrieve the surface thinner. Thinner reclaimed using this process can be used as "wash thinner" (e.g., thinner used for primer and base coats as well as to clean equipment). The reclaimed product can be used to supplement purchased wash thinner supplies. This process is currently used in parts washers where thinner purity is not critical. Gravity separation would be easy to implement and could provide valuable savings at all of the companies audited.

For the larger quantity generators in the auto body repair and painting industry, on-site distillation may provide a more cost-effective alternative. The distillation of all high-grade thinner wastes can virtually eliminate the need for purchasing lower quality thinners for use in preliminary painting operations and cleanup. From 5 gallons of paint and thinner wastes, the operator can generate 4-1/2 gallons of reclaimed thinner and 1/2 gallon of sludge. This ratio varies depending on operations. Addition of a commercial additive to the 1/2 gallon of paint sludge yields a viscous sludge which can be used as underseal. The initial capital expense to install distilling units is about $3,000. This expenditure should be recoverable in a short period of time due to decreased purchases of wash thinner and lower costs associated with transportation to an off-site reclamation facility. Operation and maintenance costs for these units could not be determined.

Waste exchanges provide another waste removal alternative for auto body and painting companies. Waste exchanges are organizations that manage or arrange the transfer of wastes between industries, such that one producer's waste material might be another industry's feedstock. Most exchanges exist as information clearinghouses which provide information on waste availability. Opportunities exist for the direct transfer (without processing) of waste solvents from industries requiring ultra-high-purity solvents (e.g., the electronics industry) to industries that do not have such exacting requirements (e.g., the machinery and painting industries). Waste solvents from some industries are available through the California waste exchange which could potentially be used as a substitute for new wash thinner. In addition, several generators have recently found new opportunities to ship residual still bottoms to cement industries for use as supplemental fuels. Facilities which currently use on-site recycling equipment, as well as those that generate large volumes of sludge, could find this alternative valuable for removal of concentrated paint sludge produced through distilling operations.

Waste oil is generated by some of the shops that do mechanical work as well as paint and body services. Secondary wastes from mechanical processes include oil filters which also must be disposed of as hazardous waste. Waste oils drained from vehicle reservoirs, such as engines, transmissions, and differentials, are generally collected in pans and emptied into 55-gallon drums for storage. Ninety to ninety-five percent of the shops turn waste oil over to waste oil reclamation companies. Drained oil filters are generally disposed of with nonhazardous refuse.

Advertisements for waste oils are common in waste exchange catalogs, with most buyers providing pickup and transport from anywhere in the United States. These exchanges provide a valuable alternative to conventional oil recycling practices and on-site treatment technologies which are not currently available. However, this may not be a viable alternative for company operators, because extremely large amounts of waste are requested by waste exchange buyers. Quantities of waste oil generated at auto service companies are too minimal to warrant such a large-scale treatment option.

Lead-acid batteries are recycled. Current RCRA and state regulations exclude lead-acid batteries from generator and transporter regulations, provided that they are to be recycled or reused. When batteries are recycled, lead is removed and processed for reuse.

Cleaning rags were found to be a large cost item for the auto body repair and paint industry. Rags are used to clean equipment, small spills, and parts with thinners. Generally, the contaminated rags are collected and cleaned by a laundry service.

CHAPTER 7

PRINCIPAL TREATMENT ALTERNATIVES

Resource recovery and recycling techniques are generally considered to be the most appropriate technologies for the disposal and waste minimization of thinners and paint sludges. If none of the previously suggested technologies are feasible, several principal treatment alternatives are available for the disposal of paint-associated wastes.

Three major waste streams must be considered when disposing of paint wastes: spent thinners, thinners in aqueous solution from clarifiers and shop runoff, and paint sludge. Many effective disposal alternatives exist for each of these waste streams, including adsorption, biological treatment, chemical oxidation, solvent extraction, solid/liquid separation, stabilization/solidification, thermal destruction, and volume reduction. These are discussed below.

Activated carbon adsorption is one of the most effective technologies for removing very low concentrations (less than 1 percent) of nonhalogenated organics from wastewater. Greater than 99 percent removal has been reported for a variety of nonhalogenated organics. When the carbon is exhausted, it may be regenerated by nondestructive methods, such as steaming or solvent washing, to remove the adsorbed compounds for recovery. Steam stripping is a type of distillation in which low boiling organics such as thinners are separated from an aqueous waste stream. In this process, steam is passed through the waste to volatilize the organics. The organic vapors are then condensed and recovered. Activated carbon beds may also be regenerated thermally in multiple-hearth furnaces. This process destroys the compounds adsorbed on the carbon and restores the adsorptive capacity of the carbon. Destructive regeneration is appropriate where a mixture of organics is being adsorbed from the aqueous waste or where the organics have little recovery value.

Biological treatment processes are also capable of treating low concentrations of certain nonhalogenated organics in water. Biological treatment methods, such as activated sludge and trickling filters, can treat most nonhalogenated solvents and liquids in dilute concentrations of water.

In the conventional activated sludge process, recycled biologically active sludge or floc is mixed in aerated tanks or basins with wastewater. The microorganisms in the floc absorb organic matter from the wastes and convert it by oxidation-enzyme systems to stable products such as carbon dioxide, water, and sometimes nitrates and sulfates or nitrogen gas (denitrification). The floc, which is a mixture of microorganisms (bacteria, protozoa, and filamentous types), acquired waste, and inert fraction can assimilate organic matter rapidly when properly active.

The technology associated with trickling filters is similar to that for activated sludge. Both processes utilize miroorganisms to oxidize organics in a waste. However, in contrast to activated sludge, waste is passed over fixed media upon which the micoorganisms are attached. Neither biological process is particularly well suited to individual small businesses.

Chemical oxidation provides a practical available technology to destroy waste substances, recover inorganic materials from the waste stream, and condition sludge for easy disposal. Several forms of chemical oxidation are currently available, but are not routinely used or particularly viable for the automotive painting industry. Wet air oxidation is one viable alternative based on the discovery that any organic material in aqueous solution or suspension can be oxidized to any desired extent by air under pressure at temperatures from 350° to 700°F. The degree of oxidation depends on the temperature and the amount of air supplied. Microbiological systems using air or pure oxygen oxidation will probably not tolerate well above 5 to 10 percent concentration by weight of the toxic organic chemical load in water. Catalytic oxidation systems, however, probably have no upper limit in concentration. This process is currently in use for the disposal of certain organic wastes at Casmalia Resources.

Extraction technologies can be effectively used for separating liquids from solids such as sludge, or for removing solvents from liquid mediums such as clarifier wastes. Extraction processes are used for the purposes of leaching or removing one of the components as a solute, when a solvent is brought into contact with a multicomponent solid or liquid. Liquids can be extracted from liquids or solids as long as the solute to be recovered is insoluble in and immiscible with the extraction solvent. This method is especially effective with paint waste, because many components, such as reducers, catalysts, isocyanate, and paint sludges are mixed together in one drum. Solvent extraction is also particularly applicable to removing nonhalogenated organics that are not volatile enough to be removed by steam stripping.

Stabilization/solidification processes are applicable to water-based paint sludges. Unfortunately, these processes are probably inappropriate for solvent-based paint sludges because of the organics present. Organics, especially oily materials, interfere with the polymerizaton of silicate materials so the cement or pozzolan-based fixatives tend to lose cohesion and fail to produce a solid set. The ash from organic wastes or sludge is a much more easily stabilized material than an unincinerated organic sludge.

Thermal destruction by incineration is currently the most widely practiced alternative to land disposal for those nonhalogenated solvent and organic liquid/sludge wastes that are not recycled. Heat can also be recovered from incineration processes, lowering the costs of thermal destruction. Liquid injection units, rotary kilns, and molten-salt units are capable of combusting the wastes with greater than 99.99 percent destruction efficiency. Air pollution control equipment is required to remove particulates, because some solvents are contaminated with metal, but corrosive gases are not generated by combustion of nonhalogenated solvents. Due to restrictions on air emissions in certain areas of California, incineration may not be a viable alternative because of the strict incinerator permitting process. Cement kilns are also capable of combusting these wastes as supplemental fuel with greater than 99.99 percent destruction efficiency.

A commercial operation in Lebec, California, co-fires wastes such as solvent and paint wastes in a rotary kiln in association with the manufacture of cement. The facility can process up to 1,200 gallons per minute (30,000 to 40,000 tons per year).

There are several volume reduction methods applicable to the disposal of paint sludges. Processes such as evaporation and centrifugation can reduce the volume of these wastes by separating liquids and solids. Evaporation is an extremely useful physical process that has been widely applied to aqueous waste management and handling. In any form of evaporation, the heat of vaporization must be applied to the material being evaporated. Where this heat energy is freely supplied by the sun and the atmosphere, its magnitude may not be appreciated. Open evaporation by the sun and atmosphere would not be allowable for organics in areas where air emissions are a problem. The DHS would not endorse such a mechanism without proper environmental safeguards. However, where steam or electrical resistance heating or some other mode of energy must be supplied, the energy-intensive nature of the evaporative process is quickly appreciated. Most organics have far lower heats of vaporization than water to begin evaporation.

Centrifugation is used in waste separation processes when a force greater than that of gravity is desired for separation of solids and fluids of differing densities, such as thinners with paint sludge.

Although these techniques have been proven effective in the disposal of thinners and paint wastes, recycling and reclamation of solvents is generally recommended. Most of the technologies discussed in this section are not readily implementable by individual small businesses.

CHAPTER 8

ECONOMICS

Of the management options discussed previously, only four have widespread applicability and can be evaluated in terms of economic feasibility. These include inventory control, source reduction, in-house recycling, and purchase of thinner through a supplier/recycler. The economics of these four approaches are discussed below.

INVENTORY CONTROL AND SOURCE REDUCTION

Not surprisingly, there is a high positive correlation between the amount of paint thinner used and the amount of waste generated. There is a hypothetical minimum amount of thinner that is essential to paint an average car; thinner use above that amount may be presumed to be waste. Figure 8-1 shows the relationship between thinner used and waste generated for the six firms audited for this study.

While it is difficult to generalize because each firm's thinner usage varies, Figure 8-1 shows a potential savings through more stringent inventory control and restrictions on thinner use. The best shop shows 0.3 gallon thinner use per car, with 0.1 gallon ending up as waste. The worst case shows 1.1 gallons per car with 0.9 gallon as waste. At 50 cars per month and $5.50 per gallon, the difference between the two shops' thinner use amounts to 480 gallons, or $2,640 annually. The waste disposal cost at $2 per gallon would add another $960 annually.

IN-HOUSE RECYCLING

According to the companies that manufacture in-house recycling equipment, it costs about $3,000 to purchase and install a recycling unit. The one firm currently using such a system anticipates being able to convert every 5 gallons of paint thinner waste into 4.5 gallons of low-grade wash thinner and 0.5 gallon of paint sludge which, with an additive, can be used as underseal. This should virtually eliminate the need to purchase wash thinner and significantly reduce purchases of underseal.

At 50 cars painted per month, savings in thinner purchases could amount to $600 to $1,000 annually. Savings in underseal are more difficult to estimate, as use rates vary widely, but at

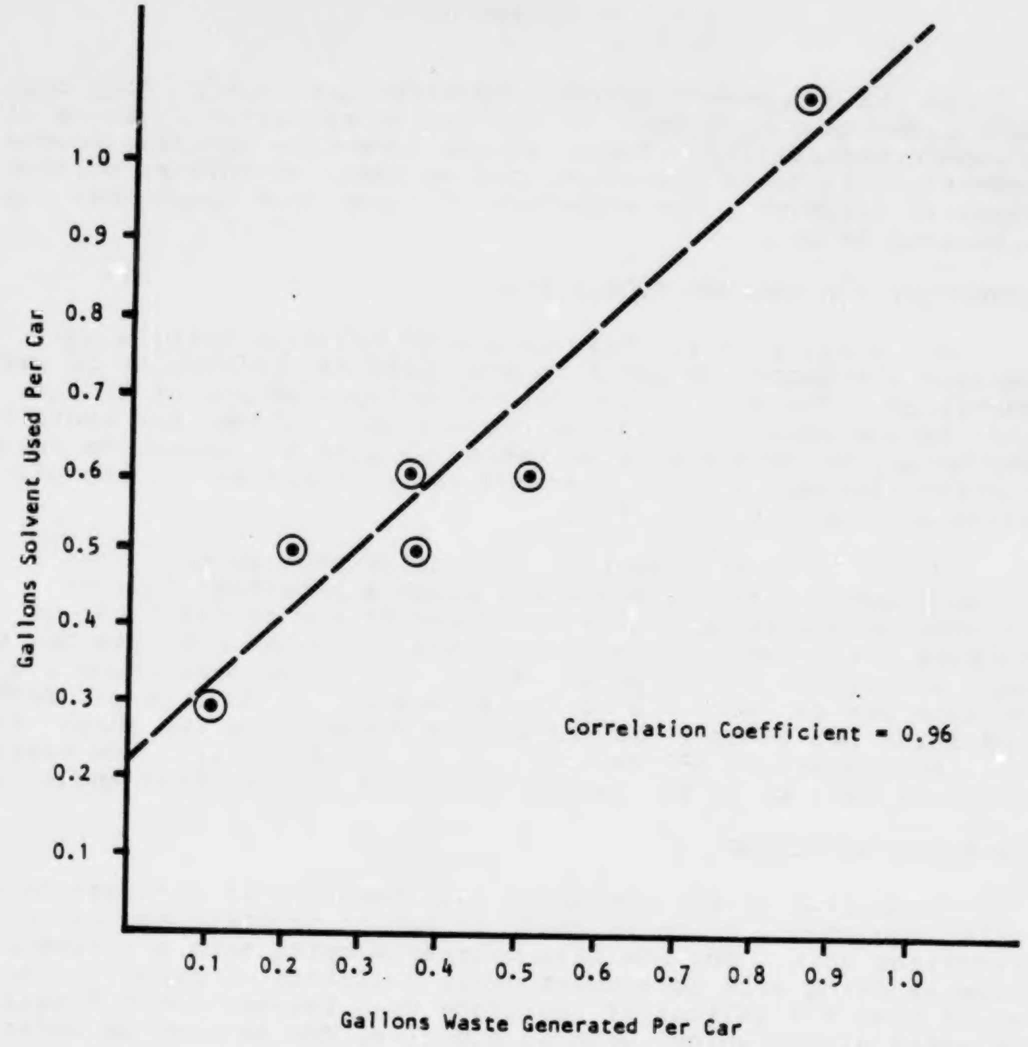


Figure 8-1. Relationship Between Solvent Use and Waste Generation Among the Audited Companies.

over $7 per 20 ounces, savings could be significant. Additionally, there are virtually no thinner wastes generated, reducing hauling or disposal costs dramatically.

Whether this is a viable alternative for a particular company depends on the volume of business. At 50 cars per month, it could take 3 to 5 years to pay for the equipment and installation. At 25 cars per month, it could take 6 to 10 years. However, at 100 cars per month, only 1.5 to 2.5 years would be required to recoup the investment.

PURCHASE THROUGH SUPPLIER/RECYCLER

It is becoming a common practice among auto painting companies to purchase thinners through suppliers who also collect and recycle the wastes. Given the current hazardous waste regulations in California, recycling is the best alternative for a company seeking to dispose of its wastes legally. In the past, this was not always the most economical alternative, since suppliers and recyclers existed as separate entities.

In general, suppliers who offer recycling services include the cost of waste collection and recycling in the price of their thinner. This increases the thinner cost, but effectively eliminates separate hauling and disposal or recycle costs. It also reduces the administrative burden on the owner or manager of the auto painting firm.

Thinner from supplier/recyclers typically costs about $2 per gallon more than comparable products from nonrecycling suppliers. Based on the companies audited, an auto painting firm will generate an average of 0.67 gallon of waste per gallon of thinner purchased. Based on a strict interpretation of these numbers, using a supplier/recycler does not become less expensive until disposal costs exceed $165 per drum.

The companies surveyed would spend an average of about $400 less per year (range, $166 to $1,052) if they bought a less expensive thinner and used a hauler. However, this does not reflect hidden administrative costs. An additional 1 to 2 hours of administrative and/or bookkeeping time per month would effectively eliminate the cost difference.

In addition, hauling and disposal costs have historically been very volatile. With changes in the regulations, hauling and disposal costs can change dramatically within a short period of time. New land disposal restrictions on thinner wastes became effective November 8, 1986. Reactions by waste service firms to the restrictions may result in total exclusion of thinner wastes from landfills after that date.

CHAPTER 9

SUMMARY OF FACILITY AUDITS

PERFORMANCE OF AUDITS

Audits were performed at six companies representing the paint and body segment of the automotive repair industry. A phased approach was taken for completion of individual audits. These phases were as follows:

1. Initial facility contact.
2. Site visit.
3. Development of alternative hazardous waste management practices.
4. Development of costs and economic payback for each alternative.
5. Presentation of recommended waste management practices.

Candidate facilities for the performance of audits were initially contacted through membership in the ASC. During the initial facility contact, company owners were briefed on the purpose of the audit, the types of information requested, and how this information was to be used. Additional information was provided to the ASC for distribution to prospective audited facilities.

The second phase of the audit was the site visit. During this visit, the actual audit of the facility was conducted. In order to facilitate the collection of information and ensure completeness, a questionnaire was developed for use during the audit (see Appendix A). The first part of the audit was spent in the company office with the owner or manager. Pertinent information was collected concerning the types of chemicals utilized, generation of hazardous wastes, disposal or reclamation practices, waste minimization, and costs associated with each of these. Information obtained from the owner or manager was verified using applicable company records.

After all information from company records was obtained, a tour of the facility and shop operations was taken. The shop tour ensured that all information was collected and processes were understood. During the tour, questions pertaining to shop operations were answered by the owner, manager, or other personnel. Any obvious deficiencies concerning waste handling operations were conveyed to the owner or manager during the shop tour.

The third phase of the audit involved the development of alternative hazardous waste management practices. These alternatives were based on:

- Conversations with suppliers for the auto paint and body industry.
- Practices employed by other audited facilities.
- Available technology and previous experience with other small-quantity hazardous waste generators.

Equipment available for minimizing the generation of hazardous wastes was identified through conversations with suppliers and through other audited facilities. All alternatives were evaluated in terms of practicality, applicability, and availability of equipment.

The fourth phase of these studies consisted of development of costs and economic payback for each alternative. Costs were developed from information collected during the audits and through contacts with paint and equipment suppliers. Where costs were not readily available, they were inferred from other sources of information.

The final phase of these studies involved the presentation of recommended waste management practices. A summary of these recommendations for the auto paint and body industry is discussed elsewhere in this report.

PROBLEMS ENCOUNTERED DURING AUDITS

In general, few problems were encountered in conducting the waste audits for this industry, largely due to the cooperation of the ASC. Because the ASC has taken an interest in this study, member shop owners have an increased incentive to cooperate in a study of this nature. Moreover, through membership in this association, they represent a more informed, exemplary segment of this industry in terms of hazardous waste management. They are, therefore, eager to implement practices that will reduce the quantity of hazardous wastes generated.

However, several minor problems were encountered during this study, including:

- Lack of full cooperation from shop owners/managers.
- Inability to change equipment due to industry standardization.

Lack of cooperation was encountered at two facilities during the waste audits. At one facility, the shop owner was not present initially, and the manager was reluctant to give out information that was construed as proprietary. However, complete cooperation was provided once the owner arrived. At a second facility, the owner did not have the time to devote his complete attention to the audit. This did not appreciably detract from the information obtained, but made the task more difficult. Lack of cooperation would not be an issue in the future if audits became mandatory and the owner became responsible for having audits performed.

The only other problem was in reference to equipment recommendations. Because equipment in this industry is standardized, it is virtually impossible to recommend equipment that results in the generation of smaller quantities of hazardous wastes. For instance, since small quantities of paint, less than 1 pint, are usually applied in this industry, an easily implemented recommendation would be to use a smaller volume paint sprayer. This practice would result in lower quantities of wastes; smaller quantities of paint would need to be mixed, less residue would remain upon completion of the work, and a smaller surface area would require cleaning. However, the smallest spray gun available on the market has a volume of 1 quart, much larger than that required for the standard painting operation. Therefore, recommending equipment changes in this industry is not practicable until new equipment becomes available on the market.

RECOMMENDATIONS FOR IMPROVING AUDIT PROCESS

The approach to conducting waste audits for the automotive paint and body industry, as presented in this report, can be applied to future audits in this industry and extended to others. However, in order to improve the audit process, several recommendations are offered. These recommendations are summarized below.

The initial questionnaire developed for performing the audits was difficult to utilize, since the auditor had to leaf through several pages while collecting information. Questionnaires were subsequently rearranged to facilitate the collection of information. The revised questionnaire is presented in Appendix A. An alternative approach to using a questionnaire is to use a blank sheet of paper to collect information, with the questionnaire serving as a guide to ensure that all of the information has been collected. This method was used with success for five of the audits.

While audits were performed, there was a tendency to concentrate on hazardous waste generation and disposal practices. An important aspect of hazardous waste management is the proper storage of waste materials. Storage was an item of deficiency at most of the audited facilities. While conducting audits, the auditor should ensure that the following practices are adhered to:

- Drums of new and waste materials are stored on a paved surface.
- New and waste materials are stored away from open floor drains.
- Controls are available for preventing spills and leaks from moving off site.
- Adequate absorbent is available for cleaning spills and leaks.
- Waste containers are properly labeled.
- Waste materials are stored for no longer than the time period allowed by law (e.g., 90 days after 100 kilograms of waste have been accumulated for hazardous waste generators of less than 100 kilograms per month).

The use of a camera while conducting audits can be useful for documenting storage and handling practices at audited facilities. Photographs can aid the auditor when recommendations are formulated, and enable those not present during the audit to conceptualize management practices. It is therefore recommended that photographs be used in the conduct of future audits.

INDIVIDUAL FACILITY AUDITS

Summaries of the audits performed at the six facilities which represent the auto paint and body industry are presented below. The audits include:

- General operating characteristics of facility.
- Management options available for hazardous wastes.
- Sources of recommended equipment.
- Facility reaction to the suggested recommendations.

Completed audit questionnaires for each facility are presented in Appendix B.

SUMMARY OF FACILITY AUDITS

Company A

Company A represents the medium-sized segment of independent operators in the auto painting industry. This company employs seven workers full-time, and has a relatively large volume of business ranging between 50 and 75 cars per month. Company A provides complete auto body repairs which include welding, alignments, frame and body adjustments, and auto painting. Most of the painting done at this shop consists of spot repairs to collision-damaged vehicles. Mechanical work on engines and drive chains is done only in association with body structure repairs.

Chemical Usage--

Raw materials utilized at this shop include paints, wax and grease remover, two grades of thinner, surface primer, retarder, reducers, and small amounts of oil used for shop machinery and vehicle maintenance.

Waste Generation--

Waste generation rates at this company are among the most conservative amounts recorded during on-site interviews. Excluding oil, all wastes are deposited in one 55-gallon storage drum which is filled at a rate of about 9 gallons per month. Waste oil from shop equipment is generated at a rate of 6 gallons per month. This waste is deposited at a local service station. Passage of SB 86, the new state waste oil bill, may affect this practice.

Operations at Company A proceed with minimal amounts of waste generated due to rigid inventory controls and several source reduction techniques. A parts cleaner is used which recycles separated solvent liquids for cleaning equipment. Paint sludges are also allowed to settle out of high-grade spent thinner so that thinner can be reused on priming and base coats.

Wash thinners and waste thinners are both stored in 55-gallon drums, with high-grade thinner in a 15-gallon can. The remainder of the products are stored in gallon cans with paints in pint- and quart-sized containers. All raw materials and wastes are stored indoors, with spigots and pumps on drums, and funnels on storage containers.

Spills are recovered with floor absorbent and disposed of with nonhazardous refuse. Paint cans are also disposed of with on-site nonhazardous refuse after paint residues have been removed.

Recommendations--

The following recommendations are suggested for management of hazardous wastes at Company A:

1. Source Reduction. This company currently employs a number of source reduction practices which have resulted in a minimum quantity of waste generated per vehicle serviced. Wastes have been minimized through the use of stringent inventory control practices and a minimum quantity of thinner used to clean equipment.

2. Disposal of Excess Paint. Excess paint is currently minimized through stringent inventory control. Residues from painting operations are disposed of in the waste thinner drum during equipment cleaning operations. Wastes can be reduced further by giving excess paint to customers for use as touch-up paint.

3. Housekeeping Practices. Product losses can be controlled through the use of tight-fitting lids to minimize evaporation. Small quantities of solvent used to wash equipment were observed in small containers with open lids. If lids are used, evaporation of materials will be reduced, further extending the usefulness of thinner.

4. Limitations on Storage. Wastes are currently stored on site. State and federal regulations limit on-site hazardous waste storage. A generator can accumulate wastes on site for up to 90 days if certain provisions are met. The generator can accumulate wastes for more than 90 days if a storage facility permit is obtained or if certain other provisions are met. Local restrictions may also apply. More details are available at the nearest offices of DHS Toxic Substances Control Division, the U.S. Environmental Protection Agency, and the local county health office.

5. Use of Manifest System. A manifest system should be used in accordance with applicable regulations. Presently, a single copy of the manifest is received with no return copy from the designated reclamation facility.

6. Spill Migration Prevention. Drums of new and waste materials should be stored to prevent off-site migration of spills or leaks. Floor drains adjacent to drum storage areas should be sealed to prevent spill intrusion.

Although this facility generates the lowest quantity of waste per automobile serviced, implementation of the abovementioned practices can result in a 5 percent reduction in the usage of new thinner. This reduction can reduce operating costs by approximately $200 per year.

Company B

Company B represents the larger independent operations in the automotive paint and body industry. This company employs 13 workers, and has a business volume of approximately 100 cars per month. Company B provides body and fender repair, frame adjustments, front and rear suspension alignments, and auto painting. Mechanical work on engines and drive chains is only done in association with body repair. This shop was somewhat different from the other audited companies, because they specialize and repair Pontiacs only, predominantly Fieros.

Chemical Usage--

Chemicals used at this shop include two grades of lacquer thinner, enamel reducer, isocyanate (a type of hardener), a catalyst, and fiberglass resin. These products are mixed together during paint operations. Thinners are stored in 30- or 55-gallon drums indoors on cement. High-grade thinner is basically used on a once-through basis. The remainder of the raw materials are stored in pint-, quart-, or gallon-sized cans and kept in a designated paint mixing area. Hand pumps and spigots are used to transfer thinner from drums to smaller containers for shop use.

Waste Materials--

The major quantity of waste is generated in association with cleaning equipment after painting operations. A single waste stream consisting of paint-contaminated thinner is generated at a rate of about 35 gallons per month. Wastes are deposited in a 55-gallon drum stored adjacent to new materials in the shop area.

Several weeks prior to the interview, Company B installed a Resolv-R distiller to help reduce the amounts of waste generated by painting operations. At the time of the interview, the new equipment had not yet been in use long enough to determine the impact on waste generation and minimization. The owner anticipates that the distiller will eliminate the need to purchase lower grade thinners for equipment cleanup. High-grade purchased thinner will be used on top coats. Thinner wastes generated from paint operations are recycled through distillation and used as wash thinner. The distiller is equipped to recycle 5 gallons of waste per use and yield 4.5 gallons of wash thinner and 1/2 gallon of paint sludge. The sludge can also be combined with additives to be used as underseal. In practice, the distiller should dramatically reduce thinner consumption and generation, and also provide a usable end product from the associated paint sludges.

Recommendations--

The following recommendations are suggested for management of hazardous wastes at Company B:

1. Source Reduction. As a result of on-site reclamation practices and the use of sludge generated from the distillation process, this facility generates no waste requiring disposal. This means that 100 percent waste reduction is possible for auto paint shops. A reduction in the quantity of material requiring distillation can be achieved through source reduction practices such as inventory control.

2. Segregation of Excess Paint Waste from Thinner Waste. A higher quality product requiring on-site reclamation can be obtained by segregating excess paint from thinner waste. An alternative to segregation is to give excess paint to customers for use as touch-up paint.

3. Permits. According to current state regulations, a TSD permit is not generally required for companies using on-site reclamation. Although a permit is apparently not required, it is suggested that state and local regulatory agencies be contacted before installing any on-site waste management facilities.

Through the implementation of these recommendations, Company B can reduce consumption of new thinner by 10 to 20 percent. Annual cost savings attributable to a decrease in the quantity of thinner purchased is estimated between $350 and $700 per year.

Company C

Company C represents a medium-sized operation in the automotive paint and body industry. This company currently employs 13 workers, and paints or repairs about 55 cars per month. Company C provides complete collision repair such as welding, mechanical work, body repair, and painting. This company is different from most of the other shops in this industry, since it performs more extensive vehicle maintenance operations.

Chemical Usage--

Chemicals used at this shop form a more extensive list than most shops due to their extended repair services. Raw materials such as acrylic lacquer thinner, acrylic enamel paints, degreasing solvents, oil, transmission fluid, brake/hydraulic fluids, and antifreeze are used on a daily basis.

Many of the above-mentioned chemicals are used to replenish fluid levels in cars without requiring fluid removal; therefore, the amounts of waste generated are significantly less than the unused chemicals. The most predominant waste streams are paint and thinner residues, waste oil, and antifreeze from radiator flushing. These combined groups of wastes are generated in equal amounts at a rate of about 20 gallons per month. Thinners are used on a once-through basis only, with no reuse after solid/liquid separation.

Most solvent, oil, and engine fluids are stored in 55-gallon drums, with the remainder of the products kept in 5-gallon drums or pint- and quart-sized cans. All drums and containers are stored indoors with tightly sealed lids and spigots or pumps. The materials are not stored in one area, but rather are dispersed around the shop at points of highest use. The pint- and quart-sized paint cans are stored inside several metal cabinets which are located indoors. Although small spills looked fairly common, the material was absorbed with floor dry and deposited in a refuse dumpster.

Company C was the only shop which had extensive amounts of open soil on its premises. Areas between buildings were predominantly packed dirt. Laying cement between adjacent building areas could help reduce airborne dust at work locations and contain spills and drips for ease of cleanup.

Floor washings are performed periodically to remove accumulated debris. Runoff is flushed into one of several floor drains located throughout the shop area. A clarifier is connected to floor drains to intercept any contaminants which may be rinsed down shop drains. Clarified runoff is discharged to the sanitary sewer.

Waste Generation--

The largest volume of waste at Company C is paint thinner, generated at a rate of 20 gallons per month. Paint thinner, waste solvent, and waste oils are removed off site through the services of a reclamation facility. Used batteries are collected and stored for subsequent removal by a salvage company.

Similar to new materials, wastes are stored in several areas of the facility, adjacent to areas of highest use. Wastes are stored in 55- or 30-gallon drums indoors on concrete. Wastes are transferred to drums from smaller containers using funnels.

Recommendations--

The following recommendations are suggested for management of hazardous wastes at Company C:

1. Improvements of Housekeeping Practices. Product losses can be reduced through the use of tight-fitting caps and seals on containers and waste drums. Funnels should be used whenever possible to minimize spillage.

2. Source Reduction. Source reduction practices can be readily implemented at this company. Such practices include the minimization of thinner used to clean equipment. Thinner use can be minimized through stringent inventory control. Another source reduction practice would be to decant and reuse gravity-separated solvent for cleaning equipment. A follow-up wash with clean material will ensure that equipment is adequately cleaned.

3. Disposal of Excess Paint. The most obvious practice for the minimization of paint requiring disposal is to mix smaller quantities of paint. However, as it is often not possible to predict the exact quantity of paint required for each job, the generation of excess paint is inevitable. Excess paint should be disposed of in a separate waste paint container or given to customers to be used as touch-up paint. Disposal to a waste thinner drum would further diminish the quality of this material, preventing its reuse as wash thinner. Therefore, this practice is discouraged.

4. Use of Manifest System. The manifest is used to track hazardous wastes from the point of generation to disposal. When wastes are picked up by the transporter, two copies of the manifest are given to the generator. One copy is submitted to the DHS within 30 days. After 35 days, the generator receives a signed copy verifying that the waste was received by the designated facility. If a copy of the manifest is not received within 45 days, an exception report should be filed with the DHS.

5. Spill Migration Prevention. Drums of new and waste materials should be stored in such a manner that offsite migration of any spills or leaks is prevented. Floor drains adjacent to drum storage areas should be sealed to prevent spill intrusion.

Through implementation of source reduction and housekeeping practices, it is estimated that a 20 to 25 percent reduction in new thinner usage can be achieved. This reduction translates to an estimated annual cost savings between $600 and $750.

Company D

Company D is a medium-sized independent operation in the automotive paint and body industry. This company employs nine full-time workers, and has a business volume of approximately 30 to 40 cars per month. This particular operation consisted of two shops located on one city block. The main shop is used for body repair and for preparing vehicles for painting. The second shop is used for painting operations only. Because these shops are physically separated, only the painting operations were actually audited. Company D provides complete collision repair, frame and suspension adjustments, and painting. As in most other auto body shops, mechanical work on engines and drive chains is done only in association with body repair.

Chemical Usage--

Chemicals used at the painting shop include enamel reducer, two grades of thinner, and small amounts of motor oil for facility vehicle maintenance. The enamel reducer and thinners are combined with the pigments during painting operations. The use and quantity of these materials depends on the type of paint applied (enamel or lacquer), type of finish required, and specifications for the particular color applied.

Waste Generation--

Hazardous waste generated at this shop consists of waste thinner, spent paint booth filters, and small quantities of waste oil. The major quantity of waste is thinner generated during equipment cleaning operations. Waste thinner is generated at a rate of approximately 30 gallons per month. Based on the volume of business, this generation rate is higher than other audited companies. This high waste generation rate can be attributed to the use of thinner on a once-through basis only, with minimal product reuse.

Wastes are recycled through a lacquer supply company which charges a unit price for transport and delivery of raw material supplies and reclamation of generated wastes. Company D is also using a new type of styrofoam paint booth filter which can be dissolved into the waste thinner when it becomes saturated with paint contaminants. Most of the other facilities use conventional booth filters which are disposed of with the nonhazardous refuse. The styrofoam filter could possibly be made a requirement to reduce the contamination of municipal refuse. However, the effect of styrofoam on the recyclability or incinerability of the waste thinner must be investigated.

Small amounts of waste oil are generated at a rate of about 7 gallons per month. Motor oil is used for shop vehicles only, and is recycled through an adjacent service station.

Thinners and thinner wastes are stored in 55-gallon drums with the remainder of the paints and chemicals stored in pint-, quart-, and gallon-sized containers. All drums and cans are stored indoors with tightly sealed lids and spigots or pumps. The materials are not stored in one area, but are instead scattered around the paint shop.

Recommendations--

The following recommendations are suggested for the management of hazardous wastes at Company D:

1. Source Reduction. When compared with other audited facilities, this company generates a fairly large quantity of waste for each vehicle painted. Source reduction practices should be implemented to minimize the volume of waste generated.

2. Housekeeping Practices. Through the implementation of housekeeping practices, material losses through spillage and evaporation can be minimized. Spillage can be reduced through the use of hand pumps and funnels during material transfers; evaporation can be minimized through the use of lids.

3. Segregation of Excess Wastes from Thinner Wastes. Contamination of thinner can be reduced through the segregation of excess paint wastes from thinner wastes. Alternatively, excess paint can be saved and given to customers for use as touch-up paint.

4. Spill Migration Prevention. Drums of new and used materials should be stored in such a manner that off-site migration of any spills or leaks is prevented. Floor drains located adjacent to storage areas should be sealed.

Through implementation of these recommended practices, it is estimated that at least a 50 percent reduction in new thinner usage can be achieved at Company D. At a cost of $6 per gallon, this reduction in thinner usage translates to an estimated cost savings of $1,300 per year.

Company E

Company E represents the smaller independent operation in the automotive paint and body industry. This company employs seven workers, and has a business volume of approximately 30 cars per month. Company E provides auto body repair and painting. Most of the painting done at this company is spot repairs to collision-damaged vehicles. Mechanical work on engines and drive chains is only done in association with body repair.

Chemical Usage--

The chemicals used at this shop include lacquer thinner, Bondo, oil, antifreeze, and paints. Not all of these raw materials generate corresponding waste streams. Radiators on damaged vehicles are often punctured and broken, resulting in fluid loss before the vehicle enters the facility. Once repairs are completed, new antifreeze is added to the empty reservoir. Bondo, a putty-like raw material, creates a waste in the form of fiberglass dust. This dust settles very slowly, but is eventually discharged in shop sweepings or rinsed down drains during washdowns.

Waste Generation--

The most predominant waste streams consist of thinners with paint sludges and spent oils. These are both generated at a rate of roughly 20 gallons per month. Thinners are used on a once-through basis only, with no reuse after solid/liquid separation.

The thinner and oil are both stored in 55-gallon drums. Paints are all stored in cans ranging from pint to gallon size. All drums and containers are stored indoors, with tightly sealed lids and spigots or pumps. The drums are stored in various locations around the facility at points of highest use. All paint materials are stored in a lockable storage/paint mixing area.

In general, this shop is kept very clean and well organized; it is undoubtedly swept and washed down on a routine basis.

Recommendations--

The following recommendations are suggested for the management of hazardous wastes at Company E:

1. Source Reduction. The quantity of hazardous waste generated and utilization of new material can be reduced through the implementation of source reduction practices. These practices include inventory control and reuse of spent material.

2. Housekeeping Practices. Although housekeeping practices at this shop are excellent, additional practices may reduce leakage, spillage, and losses through evaporation. All containers used for new materials and thinner should be equipped with tight-fitting lids except during times of use. Drip pans can be used to collect leaks associated with engine damage.

3. Segregation of Wastes. Through the segregation of excess paints from waste thinner, a higher quality waste thinner can be obtained. Waste thinner can then be reused in preliminary equipment washings.

4. Use of Manifest. Proper documentation of waste transport and reclamation has not been received at this facility. Copies of manifests have not been forwarded to DHS, and return copies have not been received upon arrival of waste at the reclamation facility. Proper use of the manifest system must be implemented.

5. Spill Migration. New materials and wastes are stored on cement in covered areas at this shop. However, runoff from spills and leaks can potentially migrate off site due to the topography of the shop. Efforts to control potential spills and leaks should be implemented and floor drains adjacent to storage areas should be secured or sealed. The generator should verify that on-site storage of new materials and wastes is being done in accordance with state, federal, and local regulations.

Through implementation of the above practices, it is estimated that a 10 to 15 percent reduction in the use of new thinner can be attained. This reduction will result in a cost savings of $400 to $600 per year.

Company F

Company F was the smallest of the six independent automotive paint and body operators interviewed during this study. This company employs three full-time workers, and has a business volume of approximately 25 vehicles per month. Company F provides auto body structural repair and painting services only. The majority of this company's work entails minor body repairs, and spot painting using enamel paints almost exclusively. Mechanical work that would generate fluid wastes is not performed.

Chemical Usage--

The chemicals used in this shop form a somewhat less extensive list than some shops, because no oils or engine fluids are used or generated on site. Raw materials such as enamel reducer, enamel catalyst, and two grades of lacquer thinner are used on a daily basis.

Waste Generation--

Company F generates two predominant waste streams. One is composed of a mixture of paints, thinners, catalysts, and reducers. These compounds are mixed together in a 55-gallon storage drum, and are generated at a total rate of about 5 gallons per month. Wastes are removed every 3 months by a lacquer supplier for the purposes of recycling. The supplier provides both new solvent and waste removal, which are included in a total service cost. The second waste stream is composed of paint residues which are mixed for each individual project. One partially filled can of paint is generated for each car painted. When the vehicle is finished, the extra paint is given to the customer to use for touch-up work.

Waste streams generated at this shop are very modest. The owner uses rigid inventory control and many basic housekeeping techniques, such as thinner reuse for cleanup and base coats, which substantially reduces the amounts of waste generated.

These programs have been efficient in minimizing waste streams and increasing economic returns at Company F.

Both new thinner and stored wastes are kept in 55-gallon drums. Both of these containers have appropriate material transfer devices such as spigots, pumps, or funnels. Drums are stored in a locked, steel-bottomed, outdoor storage shed. Drums are grounded to an adjacent water pipe to eliminate the risks of generating sparks near flammable products. Paints are stored in quart- or pint-sized cans, with the remainder of the raw materials in 1- or 15-gallon containers. These materials are all stored indoors in a segregated paint mixing area.

Recommendations--

Very few recommendations can be offered to this company to minimize the generation of hazardous waste. Inventory control and reuse practices are implemented to reduce the quantity of thinner utilized at the facility. Excess paints are segregated from thinner wastes and given to customers for use as touch-up paint. Housekeeping practices are implemented to minimize spillage and leakage. In addition, the owner of this company keeps informed of hazardous waste regulations through trade organizations.

CHAPTER 10

SELF-AUDITS

INTRODUCTION

Within the last few years, increasing pressure has been placed on industry to be aware of and comply with regulations designed to protect the environment and public health. Under these regulations, anyone producing, using, storing, transporting, or disposing of hazardous materials can be held responsible for environmental damage caused by these materials. This can potentially result in:

- Financial liability for injury.
- Denial of an insurance claim.
- Inability to secure adequate insurance coverage.
- Payment of regulatory agency fines or court awards.

Added to this are additional burdens placed on industry by the general public and the news media. For these reasons, it is important for industry to identify and minimize its potential liabilities arising from hazardous material handling practices.

The purpose of a waste audit is to identify opportunities for reducing the generation of waste. At the same time, it should reveal existing and potential problem areas requiring corrective actions. A waste audit typically has several phases which involve record reviews, site visits, and data analysis.

Records to be reviewed may include purchase orders, environmental permits and licenses, manifests, disposal records, process material balances, and production records. Site visits are intended to assess existing operating and management practices. Finally, data analysis should be designed to inform the company of methods to reduce legal and economical liabilities.

The overall goals of the self-audit are to evaluate operations that result in the generation of hazardous wastes, assess the adequacy of waste handling practices, and implement procedures for reducing the amount of wastes generated or the costs of waste handling.

BACKGROUND

Due to their convenience and low cost, landfills have traditionally been used for the disposal of hazardous wastes. However, because of problems associated with this practice (e.g., pollution of ground water), the use of landfills for waste disposal is gradually being phased out in California. As an alternative to land disposal, several programs have been initiated by the California Department of Health Services (DHS) to reduce the quantities of hazardous wastes requiring disposal.

Waste minimization at the point of generation is effective in reducing the overall quantity of hazardous wastes that require disposal. Through performance of a waste audit, practices can be implemented to reduce the quantity of waste generated, thereby effectively lowering operations costs. In addition, environmental audits can ensure that hazardous waste management practices are in compliance with state regulations.

This chapter presents information and guidelines to be followed when performing a self-audit, i.e., an audit performed by a shop owner or manager. Self-audits generally address source reduction practices such as changes in equipment, process automation, and housekeeping practices. In addition, the benefits of alternative waste disposal practices such as reuse, reclamation, waste exchange, and treatment technologies can be evaluated.

APPLICABLE STATE REGULATIONS

Hazardous wastes are subject to regulation per the requirements of the California Hazardous Waste Control Act (California Health and Safety Code, Division 20, Chapter 6.5). Regulations pertaining to the management of hazardous wastes are contained in the California Administrative Code, Title 22, Social Security, Division 4, Environmental Health, Chapter 30. Those regulations pertinent to generators of hazardous waste are summarized in Table 10-1. It is suggested that the auditor become familiar with these regulations prior to conducting an audit. The DHS or your local trade organization may be able to provide you with more detailed information about the pertinent regulations.

CONDUCTING A SELF-AUDIT

This section presents guidelines to be used when performing a self-audit. The guidelines can simplify the audit procedure, especially when several waste streams are generated. The use of a form for the collection of information simplifies the process and provides guidance for determining relevant information. The audit questionnaire shown in Figure 10-1 has been developed to simplify the audit process for facilities in the paint and body segment of the automotive repair industry. Before conducting an audit, the auditor should review the questionnaire thoroughly to become familiar with the steps involved and the types of information which must be collected.

There are basically five steps to be followed when conducting an audit, as follows:

- Shop tour.
- Collection of information.
- Evaluation of waste management practices.
- Development of alternatives.
- Estimation of costs for each alternative.

Step 1. Shop Tour

The purpose of the shop tour is to become acquainted with shop operations specifically dealing with the storage, handling, treatment, and disposal of chemicals and wastes. Although this step may not be required for those familiar with shop operations, it is recommended to obtain an overview of all waste handling operations and to begin to evaluate possible changes in operations. Although certain changes may initially seem impractical, they may be worth consideration. Moreover, a shop tour may reveal that actual waste handling practices are different than those originally envisioned or used in the past.

Step 2. Collection of Information

Gather all information relating to the purchase, storage, handling, and disposal of chemicals and wastes from company files. Pertinent documents would include invoices, shipping documents, waste hauling manifests, biennial waste generation reports, and any receipts obtained from reclamation facilities.

Based on the information collected as well as your knowledge of shop operations, complete the questionnaire provided in Figure 10-1. If there are doubts or questions about any of the practices used, return to the shop and observe these practices or consult personnel familiar with these operations.

Following are step-by-step instructions for filling out the questionnaire. The significance of each of these items will be discussed later in this chapter.

Item 1. General Information. This information is usually not required unless the form is to be sent to a corporate headquarters or to someone who will review the questionnaire. At a minimum, fill in the number of automobiles serviced per month and the number of company employees, since this information will be required in subsequent phases of the audit.

Item 2. Chemical Usage. From the list presented, check the types of chemicals used at your shop. If any chemicals are used which do not appear on the list, identify them under the "Other" category.

For each chemical identified, estimate the quantity in storage (in gallons), the usage rate (gallons per month and gallons per car) and cost (dollars per gallon). This information can generally be obtained from purchase invoices; you may modify the numbers obtained from invoices if you feel that they are not typical of normal operations. If this information is not readily available, provide estimates based on your knowledge of shop operations.

Item 3. Chemical Storage. A separate Item 3 must be completed for each chemical identified in Item 2 above. Item 3 identifies the practices associated with storage and use of each chemical. Fill in the name of the chemical in the space provided.

Describe how each chemical listed above is used. For example, "wash" thinner is typically used to clean equipment, whereas "high quality" thinner is used as a carrier to thin out paint. The distinctions between these uses is a significant consideration when evaluating waste management alternatives. The substitution of a nonhazardous product for wash thinner may be possible without sacrificing product quality. However, the same may not hold true for high-quality thinner.

Also, specify the type of container used to store the material and the volume of each container. Identify if the container is aboveground or underground.

Check each of the items listed under "Storage Area" which apply to the storage area used for the subject chemical. Identify the type of delivery system used to transfer materials from the container to smaller containers. This is an important consideration for the minimization of spills and evaporation losses.

Items 4 and 5. Waste Generation. Identify the hazardous wastes that are generated as a result of the chemicals used at your shop. For each waste, indicate the rate of generation (in gallons per month and gallons per car) and the physical state of that waste (i.e., liquid, sludge, or liquid/sludge mixture). If wastes are mixed together, describe which wastes are combined and estimate the rate of generation for the combined waste. If any of the above wastes can be used as process materials for another operation, complete Item 5c.

Item 6. Waste Management Practices. For each waste generated at your shop, a separate Item 5 will need to be completed as follows:

- Item 6a. Waste Storage. From the list presented, determine the type and volume of container used to contain each waste. If multiple containers are used, list the size of each container and the combined total volume. Also, check all items listed in Part 2 of this question which apply to the waste storage area.
- Item 6b. Waste Removal. Identify how wastes are removed from the shop. Determine if the hauler uses a pump truck or removes the entire drum. Also, estimate the frequency with which wastes are removed, and determine whether a waste manifest is received from the hauler when wastes are removed.
- Item 6c. Waste Minimization. Identify practices used at the shop to reduce the quantity of waste generated at the shop. A few of the more common practices such as material reuse, use of a parts cleaner, and on-site distillation are already listed. However, other practices which may be effective for the reduction of wastes may also be in use at your shop. For each practice, describe the end products, the volume, and the disposition or reuse of these end products, if applicable.
- Item 6d. Disposal Practices. Identify the method used to dispose of generated wastes, and indicate the cost of disposal (in dollars per gallon).

Item 7. Waste Stream Schematic. In the space provided and using the basic waste stream diagram, fill in the applicable chemical usage and waste generation rates. This schematic helps to visualize material usage and waste generation rates, and is also effective in identifying unaccounted waste losses. If the waste schematic that has been provided does not adequately illustrate your material usage/waste generation situation, design your own schematic. Any unaccounted losses should be quantified on the schematic.

Step 3. Evaluation of Waste Management Practices

In this step, current waste management practices will be evaluated for compliance with hazardous waste regulations. This is accomplished through the evaluation of your responses to several questions in the questionnaire (Figure 10-1). Those practices which are not in accordance with state regulations must be changed in order to comply with existing laws.

Chemical/Waste Storage Practices. Generally, materials should be stored in a covered area in containers which are in good condition and compatible with the material in storage. Containers should be stored on an impermeable surface to prevent soil contamination in the event of a leak or spill. It is also good practice to store materials in an area where runoff is contained; to determine the route of runoff if a spill should occur; and to ensure that the potential for off-site migration of materials (e.g., through a storm or floor drain) is minimized. If the potential for off-site migration exists, you may wish to consider installation of a curb to contain the storage area.

The use of spigots, pumps, and funnels for delivery of materials from containers is also a good practice. The use of these items will minimize losses due to spillage and evaporation. Spigots, pumps, and funnels should be checked for leakage, and containers should be covered with tight-fitting lids to prevent evaporative losses. The use of tight-fitting lids and non-leaking delivery systems is of particular importance for volatile substances such as paint thinner. This applies to waste materials as well as unused materials.

Another measure which can be used to minimize material losses is inventory control. If materials are less accessible, personnel using them will generally find ways of extending their usefulness.

Waste Removal. According to hazardous waste regulations, the only acceptable methods of hazardous waste removal involve the use of a licensed private waste hauler or the services of a reclamation company. Hazardous wastes should not be disposed with ordinary refuse in a refuse dumpster. The use of a reclamation company for the removal of wastes has been found to be cost-effective for most shops in this industry. Wastes can be removed through the use of a pump truck or by removal and replacement of a container.

Hazardous wastes should be removed from company premises within 90 days. Shops which generate less than 100 kilograms of wastes per month in any calendar month are exempt from this 90-day requirement. Most small shops in this industry generate less than 100 kilograms of waste. Under these circumstances, the 90-day period begins when 100 kilograms of waste have accumulated. Generally, 100 kilograms of thinner waste translates to approximately 25 to 30 gallons.

A waste manifest should be received from the waste hauler for every pickup and removal episode. Exceptions to the waste manifest requirement are:

- Waste thinner removed off site by Pacific Coast Lacquer (PCL). The process used by PCL to recycle wastes is exempt from the manifesting requirement.

- Waste oil removed off site by a recycler that has obtained a variance from the DHS. Haulers who have obtained such a variance need only fill out a single manifest for all wastes collected each day. If your waste oil hauler does not have a variance, a manifest must be filled out each time wastes are removed.

Waste Minimization. What other practices can be implemented for the minimization of wastes? A few of the more common practices are listed in the questionnaire (Figure 10-1). However, other methods can be used which may effectively reduce the amount of waste generated. Potential minimization practices include:

- Substitution with materials which do not result in the generation of a hazardous waste, e.g., substitution of aqueous-based paints for solvent-based paints.

- Equipment changes. One possible equipment change would be the use of a sprayer that has a smaller volume than the standard 1-quart sprayers; use of this type of sprayer would result in a smaller surface area that would require cleaning. Another equipment change would involve the use of a solvent separator which allows thinner to separate from sludge, thereby allowing the thinner to be reused.

- Rigid inventory control. In general, the more material that is used, the greater the volume of waste generated. Reducing material use should reduce waste generation.

- Substitution of waste materials for process chemicals where purity is not critical, e.g., the use of contaminated thinners for "wash thinner."

- Improved housekeeping techniques to reduce spills and leaks.

Step 4. Development of Alternatives

From data collected on the questionnaire (Figure 10-1), compare the amount of thinner and other materials purchased to the amount of waste generated. From your calculations in Item 4a of the questionnaire, determine if the amount of waste generated is within acceptable limits. If not, what practices can be implemented to control product losses? Possible measures which can be implemented to minimize the amount of waste generated include the following:

- Source reduction:
  - Use of spigots or pumps on drums.
  - Inventory control.
  - Improved drum handling to prevent spillage.
  - Distribution of leftover paint to customers for use as touch-up paint.
  - Change in equipment.
  - Change to chemicals that do not generate hazardous wastes.
- Recycling:
  - Recycling service.
  - Gravity separation.
  - Recycling of paint thinner to wash thinner.
  - On-site distillation.
  - Waste exchange.
- Evaporation control:
  - Covered sinks and dip tanks.
  - High freeboard on dip tanks.
  - Improved location (e.g., out of direct sunlight or strong drafts).
- Alternatives for cast-off parts:
  - Batteries.
  - Rags.
  - Containers.

Step 5. Estimation of Costs for Each Alternative

For each of the potential alternatives developed above, estimate the cost of implementation. This cost can be calculated using the worksheet provided in Figure 10-2. Costs for each of the alternatives must be obtained from vendors or reclamation companies.

Through the use of the worksheet, cost savings for each implemented practice can be estimated. In addition, costs of present waste management operations can be compared with costs to implement any of the alternative practices.

TABLE 10-1. SUMMARY OF HAZARDOUS WASTE REGULATIONS APPLICABLE TO HAZARDOUS WASTE GENERATORS IN THE AUTO BODY REPAIR INDUSTRY

CALIFORNIA HAZARDOUS WASTE CONTROL ACT

Article 2. Definitions

Section 25113. "Disposal" means to abandon, deposit, inter, or otherwise discard a waste.

Section 25116. "Handling" means the transporting or transferring from one place to another, or pumping, processing, storing, or packaging of hazardous wastes, but does not include the handling of any waste before it becomes a waste.

Section 25117. "Hazardous Waste" means a waste, or combination of wastes, which because of its quantity, concentration, or physical or chemical characteristics may cause harm to human health or to the environment.

Section 25117.7. "Hazardous Waste Facility" is any land or structures used for treating, storing, or disposing of hazardous wastes.

Section 25120.5. "Recyclable Material" is a hazardous waste that is capable of being recycled and is a residue, or a material designated by the EPA as recyclable. For this industry, recyclable materials include solvents and paint thinner.

Section 25122.6. "Small Quantity Producer" means a person who produces less than 1,000 kilograms of hazardous waste in any month.

Section 25123. "Storage" means the containment of hazardous wastes, either on a temporary basis or for an extended period in such a manner as not to constitute disposal or use of such hazardous waste.

Section 25123.3. "Storage Facility" means a hazardous waste facility in which wastes are stored for a period greater than 90 days. The time period for calculating the 90 day period begins when the facility has accumulated 100 kilograms of hazardous waste except that, if the facility generates more than 100 kilograms of hazardous waste during any calendar month, the time period begins any amount of waste begins to accumulate.

TABLE 10-1 (continued)

Section 25123.5. "Treatment" means any method, technique, or process which changes the physical, chemical, or biological character or composition of any hazardous waste or any material contained therein, or removes or reduces its harmful properties or characteristics for any purpose.

HAZARDOUS WASTE MANAGEMENT REGULATIONS

Article 6. Requirements for Generators of Hazardous Waste

Section 66471. Hazardous Waste Determination Requirements. Generators are responsible for determining if the waste is a hazardous waste according to the provisions in Articles 9 and 11 of the regulations.

Section 66472. A generator of hazardous wastes must obtain an EPA identification number. A generator cannot offer his hazardous waste transporter without having received a hazardous waste identification number.

Section 66480. A manifest shall be prepared by the generator before offering wastes to a transporter for treatment, storage, or disposal.

Section 66484. Generator Use of the Manifest. The generator shall:

(1) Complete the generator and waste section and sign the manifest certification.

(2) Obtain the signature of the initial transporter and date of acceptance on the manifest.

(3) Retain two copies of the manifest.

(4) Submit a legible copy of each manifest to the Department of Health Services within 30 days of shipment.

(5) Contact the transporter, owner, or operator of the designated facility to determine the status of the waste if a copy of the manifest is not received within 35 days of the date the waste was accepted. An exception report should be submitted to the Department if a copy of the manifest is not received within 45 days.

Section 66492. Recordkeeping Requirements. Generators should retain copies of all manifests, biennial reports, exception reports, test results, and waste analyses for at least three years.

TABLE 10-1 (continued)

Section 66493. Biennial Reporting. A Biennial report shall be submitted to the Department by March 1 of each even numbered year. The Biennial Report will be submitted on Department forms and shall cover waste generator activities during the previous calendar year.

Section 66504. Packaging, Labeling, Placarding, and Marking Requirements. Wastes should be packaged, labeled, and placarded in accordance with applicable Department of Transportation regulations. Mark each container of 110 gallons or less used for transportation with the following words:

HAZARDOUS WASTE - State and federal law prohibits improper disposal. If found, contact the nearest police or public safety authority or the California Department of Health Services.

Generator's Name and Address: ______________________

____

Manifest Document Number: ______________________

FIGURE 10-1. HAZARDOUS WASTE AUDIT QUESTIONNAIRE

1. General Information.

Company Name: ____________________

Company Address: ____________________

Company Phone: (___) ____________________

Contact: ____________________

Type of Business (Check those which apply):

___ Auto Painting ___ Body Repair ___ Frame Repair

___ Mechanical Repair ___ Other (Specify) ____________________

Average Number of Automobiles Serviced Per Month ____________________

SIC Code(s) ____________________

Number of Employees ____________________

2. Which of the following chemicals are used in your operations?

Chemical	Quantity Stored (Gal)	Usage Rate (Gal/Mo)	Usage Rate (Gal/Car)*	Cost ($/Gal)
___ High-Grade Thinner				
___ Wash Lacquer Thinner				
___ Lacquer Paint				
___ Enamel Paint				
___ Enamel Reducer				
___ Retarder				
___ Surface Primer				
___ Enamel Catalyst				
___ Hardener/Isocyanate				
___ Fiberglass Resin				
___ Wax and Grease Rem.				
___ Oil				

FIGURE 10-1 (continued)

2. (continued)

Chemical	Quantity Stored (Gal)	Usage Rate (Gal/Mo)	Usage Rate (Gal/Car)*	Cost ($/Gal)
___ Cleaning Solvent	________	________	________	________
___ Carburetor Cleaner	________	________	________	________
___ Brake/Hydraulic Fluid	________	________	________	________
___ ________________	________	________	________	________
___ ________________	________	________	________	________
___ ________________	________	________	________	________
___ ________________	________	________	________	________
___ ________________	________	________	________	________
___ ________________	________	________	________	________

* Calculate gal/car usage rates by dividing the gallons per month by the average number of automobiles serviced per month.

3. Chemical Storage. This item will need to be completed for each chemical checked in Item 2. Use a separate sheet for each chemical identified.

Chemical ____________________

a. Describe how this chemical is used.

b. Storage Container:

___ 55-gallon drum

___ Containers (specify volume) ________

___ Aboveground tank

___ Underground tank

Are tight-fitting lids provided on drums? ________

Are bung holes sealed or fitted with tight valves? ________

c. Storage Area.

___ Indoors
___ Outdoors

___ Covered
___ Uncovered

___ Concrete
___ Asphalt
___ Dirt

___ Locked
___ Unlocked

FIGURE 10-1 (continued)

d. Delivery System.

___ Gravity Spigot ___ Pump ___ Funnel

___ Other ________________

e. How is material usage controlled:

___ Stockroom attendant
___ Access limited to designated personnel
___ Sign-out sheet
___ Materials readily accessible to all personnel

4. Which of the following waste-generating activities occur in your operation?

___ Paint stripping and surface cleaning
___ Body filling and repair
___ Primer and paint application
___ Paint booth
___ Paint equipment cleaning
___ Vehicle parts cleaning
___ Mechanical repair and maintenance
____
____
____
____
____

5. This item may need to be completed for each activity checked in Item 4.

a. Hazardous Waste Generated.

	Type of Waste	Physical State (Liquid, Sludge, or Mixture)			Generation Rate	
					(Gal/Mo)	(Gal/Car)*
___	High-Grade Thinner	liq___	sludge___	mix___	________	________
___	Waste Wash Thinner	liq___	sludge___	mix___	________	________
___	Waste Paint	liq___	sludge___	mix___	________	________
___	Waste Oil	liq___	sludge___	mix___	________	________
___	Cleaning Solvents	liq___	sludge___	mix___	________	________
___	______________	liq___	sludge___	mix___	________	________
___	______________	liq___	sludge___	mix___	________	________
___	______________	liq___	sludge___	mix___	________	________

* Calculate gal/car usage rates by dividing the gallons per month by the average number of automobiles serviced per month.

FIGURE 10-1 (continued)

b. Are wastes kept segregated from each other?

If not, describe what wastes are combined and estimate the combined rate of generation.

What options are available to facilitate waste segregation?

c. Could any of the above wastes be used as process materials for another activity, e.g., use of waste high-grade thinner for wash thinner or parts cleaning?

Waste Type	Activity Waste Can Be Used In:	Process Chemical Waste Will Substitute for:

6. Waste Management Practices. This item will need to be completed for each waste checked in Item 5. Use a separate sheet for each waste identified.

a. Waste Storage.

(1) Type of container used to store waste.

	Volume (Gallons)
___ Drum	
___ Sump	
___ Underground tank	
___ Aboveground tank	
___ Refuse dumpster	
___ Other	

(2) How/where is waste stored?

___ Indoors
___ Outdoors

___ Covered
___ Uncovered

___ Concrete
___ Asphalt
___ Dirt

___ Locked
___ Unlocked

FIGURE 10-1 (continued)

b. Waste Removal.

(1) Waste removal alternatives

___ Private waste hauler
___ Recycler/reclaimer
___ Public refuse collection system
___ Other ________________________

(2) How does hauler remove wastes?

___ Pump truck
___ Removal/replacement of container
___ Other ________________________

(3) How often are wastes removed? (No. of days) _______

(4) Are manifests received from hauler for off-site disposal? ____

c. Waste Minimization.

(1) Practices (Check those which apply):

___ Reuse in operations amenable to the use of lower grade materials
___ Use of parts cleaner which recycles solvents
___ On-site distillation
___ Other ______________
___ None

(2) End products. Describe end products from the above practices, volume generated, and the method used for disposal or reuse.

d. Disposal Practices.

	Cost ($/Gal)
___ Off-site reclamation	__________
___ Hazardous waste landfill	__________
___ Incineration or co-firing of wastes	__________
___ Waste exchange	__________
___ Refuse landfill	__________
___ Unknown	__________
___ Other ________________________	__________

FIGURE 10-1 (continued)

7. Provide a waste stream schematic with a material balance.

   a. Describe the processes using chemicals. What kinds are used? Usage rate?

   b. Describe the processes generating wastes. What kinds of wastes are generated? Include the generation rate per process.

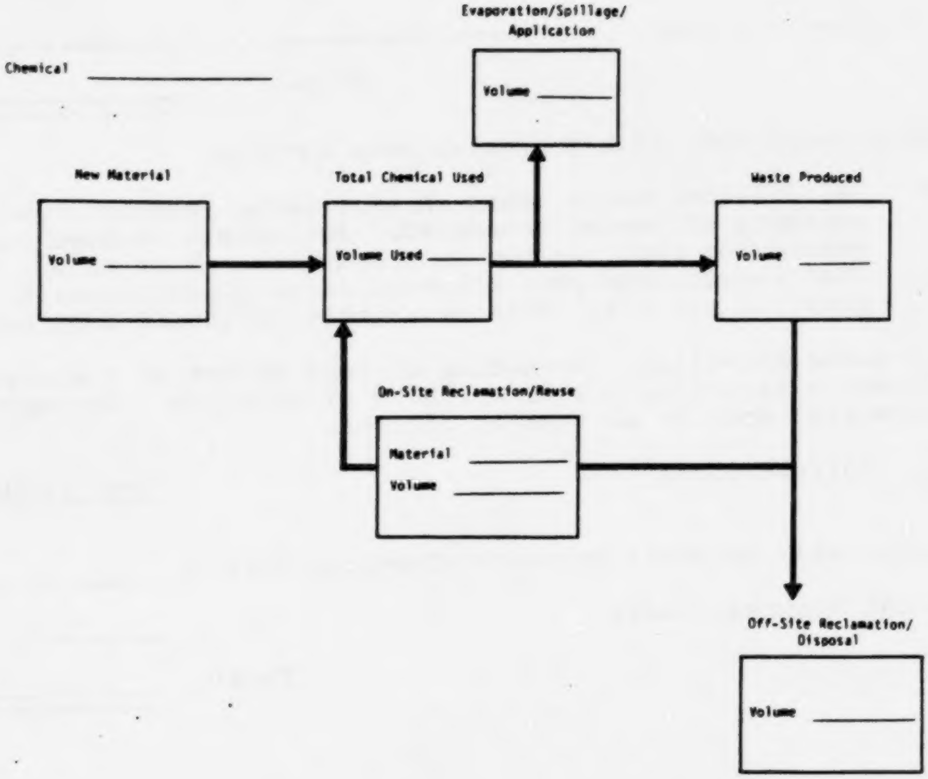

Chemical
Evaporation/Spillage/ Application
Volume
New Material
Volume
Total Chemical Used
Volume Used
Waste Produced
Volume
On-Site Reclamation/Reuse
Material
Volume
Off-Site Reclamation/ Disposal
Volume

FIGURE 10-2. ECONOMIC EVALUATION WORKSHEET

1. General Costs

    a. Total yearly income from most current year ____________
    b. Total annual chemical cost (from Questionnaire, question No. 2). ____________
    c. Total waste disposal cost (from Questionnaire, question No. 6d). ____________

2. Waste Minimization

    a. Refer to Questionnaire, question No. 5b. For each waste listed, write down the monthly cost for the process chemical being replaced.

Waste Type	Process Chemical	Cost ($/Month)
	Total	

This total cost is a potential cost savings.

    b. In addition, waste reuse in this manner should reduce the quantity of wastes generated. Estimate a revised waste generation rate (as per Questionnaire, question No. 5). Then recalculate your disposal costs (Questionnaire, question No. 6d). This is another potential cost savings.

3. In-House Recycling: Depending on your volume of business, in-house recycling may be a viable alternative. Estimate the potential cost or savings as follows:

    a. Current Costs

	Cost ($/Month)
Recyclable Solvents/Thinners (Chemical Cost)	
Total Disposal Costs	
Total	

FIGURE 10-2 (continued)

b. Recycling Equipment: Either use the numbers in the report, Chapter 6, or call a vendor for current costs for your area. Estimate the average monthly cost for the equipment amortized over the life of the equipment.

Equipment Cost ($/Month) __________

c. Estimated Operating Costs: In-house recycling will reduce chemical costs and disposal costs by replacing new chemicals with those recycled in house and by reducing the quantity of waste to be disposed. The savings are not simple one-to-one relationships, however. Some make-up solvent or additive will be necessary. Also, some residues will still be generated. Consequently, calculate costs as follows:

Chemical Costs: Use 25 percent of the chemical costs above.

Total Disposal Costs: Reduce your estimated waste quantity by 75 percent of the recyclable wastes and re-estimate disposal costs.

	Cost ($/Month)
Revised Chemical Cost	__________
Revised Disposal Cost	__________
Total	__________

d. Summary

	Cost ($/Month)
(1) Current Cost (from Item 3a above)	__________
(2) Estimated in-house recycling cost (from Item 3b plus Item 3c above)	__________

Subtract (2) from (1) above. If the result is positive, in-house recycling would achieve a tangible savings. A negative result suggests that current methods are more cost-effective.

4. Other Disposal Options: In general, any other disposal or treatment option can be evaluated in much the same way as in Item 3 above. Basically, estimate current costs, the cost of a new waste management option, the costs associated with the effect of that option or other items (chemical costs, etc.), and calculate the difference.

BIBLIOGRAPHY

California Waste Exchange. Toxic Substances Control Division, California State Department of Health Services, Sacramento, California.

Chau, P. C., D. Coffey, and D. F. Ollis. Hazardous Waste Generation and Off-Site Disposal Patterns in California. Chemical Engineering Department, University of California, Davis, California, September 1981.

Deroche, A. G., and N. N. Hildebrand. The Principles of Auto Body Repairing and Repainting. 3rd Edition. Prentice-Hall, Englewood Cliffs, New Jersey, 1971.

Dietz, S., M. Emmet, R. DiGaetano, D. Tuttle, and C. Vincent. National Survey of Hazardous Waste Generators and Treatment, Storage, and Disposal Facilities Regulated Under RCRA in 1981. EPA-530/SW-84-005, Westat, Inc., Rockville, Maryland, for Office of Solid Waste, Environmental Protection Agency, Washington, D.C., 1984.

Ghassemi, M. Technical Environmental Impacts of Various Approaches for Regulating Small Volume Hazardous Waste Generators Pursuant to the Resource Conservation and Recovery Act of 1976. TRW Environmental Engineering Division, Redondo Beach, California, for Office of Solid Waste, Environmental Protection Agency, Washington, D.C., December 1979.

Hackman, E. E., III. Toxic Organic Chemicals: Destruction and Waste Treatment. Noyes Data Corporation, Park Ridge, New Jersey, 1978.

Malone, P. G., and L. W. Jones. Survey of Solidification/Stabilization Technology for Hazardous Industrial Wastes. EPA-600/2-79-056, Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, for Solid and Hazardous Waste Research Division, Municipal Environmental Research Laboratory, Cincinnati, Ohio, July 1979.

Miskowski, D., and S. N. Popowcer. The First Steps in Determining Your Plant's Liability. Pollution Engineering. XVIII (11):51-52. November 1986.

Powers, P. W. How to Dispose of Toxic Substances and Industrial Wastes. Noyes Data Corporation, Park Ridge, New Jersey, 1976.

Ruder, E., R. Wells, M. Battaglia, and R. Anderson. National Small Quantity Hazardous Waste Generator Survey. Final Report. ABT Associates, Cambridge, Massachusetts, for Office of Solid Waste, Environmental Protection Agency, Washington, D.C., February 1985.

SCS Engineers. Development of a Hazardous Waste Management Plan for Small-Quantity Generators: North Hollywood Pilot Study. Hazardous Waste Inventory (Task A). Final Report. Prepared for Southern California Association of Governments, Los Angeles, California, November 1984.

SCS Engineers. Ground Water Quality Management Plan, San Fernando Valley Basin. Industry Survey and Development of Best Management Practices. Final Report. Prepared for Southern California Association of Governments, Los Angeles, California, August 1982.

Solvent Recovery Seminar Transcripts; Presentations from the DCI Solvent Recovery Seminar, Indianapolis, Indiana, October 27, 1981.

Stoddard, S. D., G. A. Davis, H. M. Freeman, and P. M. Deibler. Alternatives to the Land Disposal of Hazardous Waste; an Assessment for California. Toxic Waste Assessment Group, Governor's Office of Appropriate Technology, Sacramento, California, 1981.

APPENDIX A

WASTE AUDIT QUESTIONNAIRE

HAZARDOUS WASTE AUDIT QUESTIONNAIRE

I.D. No. ____________

1. GENERAL INFORMATION

Company Name: ______________________________

Company Address: ______________________________

Company Phone: (   ) ______________________________

Contact: ______________________________

Type of Business: ______________________________

Principal Product(s): ______________________________

____

Other Products: ______________________________

Volume of Business: ______________________________

SIC Code(s): ______________________________

Number of Employees: ______________________________

2. CHEMICALS USED

Chemical	Use	Quantity Stored	Usage Rate	Cost

I.D. No. ______________

3. HAZARDOUS WASTE GENERATED

Type of Waste	Source	Physical State	Generation Rate	Cost

4. WASTE STORAGE

Type of Waste	Storage	Quantity	Length of Storage	Cost

I.D. No. ______________

5. ON-SITE TREATMENT

Type of Waste	Treatment	Frequency	End Products (Quantity)	Cost

6. OFF-SITE TREATMENT

Type of Waste	Quantity	Treatment	Who/ Where	Frequency	Cost

I.D. No. ____________

7. WASTE DISPOSAL

Type of Waste	Method of Disposal	Where	Quantity	Frequency	Cost

8. WASTE TRANSPORT

Type of Waste	Method of Disposal	Who	Quantity	Frequency	Cost

I.D. No. ____________

9. Does company have an existing waste minimization plan? If yes, describe.

10. Provide a waste stream schematic with a material balance. Describe the processes using chemicals. What kind are used? Usage rate? Describe the processes generating wastes. What kinds of wastes are generated? Include the generation rate per process.

APPENDIX B

COMPLETED WASTE AUDIT QUESTIONNAIRES

HAZARDOUS WASTE AUDIT QUESTIONNAIRE

I.D. No. A

1. GENERAL INFORMATION

Company Name:

Company Address:

Company Phone:

Contact:

Type of Business: Auto Body

Principal Product(s): [illegible] frame, alignment and
[illegible]

Other Products: [illegible]

Volume of Business: [illegible] cars per month

SIC Code(s): [illegible]

Number of Employees: [illegible] full time employees

2. CHEMICALS USED

* Costs are lumped together as unit price which includes - cost of new materials, transport and treatment.

Chemical	Use	Quantity Stored	Usage Rate	Cost
High Quality Thinner	Finish Coats	15 gallons	90 days	$6.50/gal *
Solvents	Painting thinning	55 gallons	90 days	$3.60/gal *
Oil	Facility Machines/Vehicles	6 gallons	1 month	75¢/qt
Wax & Grease Remover	Cleaning/Body	5 gallons	6 weeks	unknown
Paint (Pigment)	Auto/Body	≈ 50 gallon & quart cans 1/2 - 3/4 full	variable	varies
Acrylic Surface Primer	Painting			
Retarder	Painting	≈ 20 gallon sized cans	unknown	unknown

I.D. No. ____________

3. HAZARDOUS WASTE GENERATED

Type of Waste	Source	Physical State	Generation Rate
Acetone	spent thinner components	Liquid/ Sludge	55 gallon drum- 2 times/ year
Ketone			
Xylene			
Petroleum Distillates			
Isopropyl Alcohol			
Methanol			
Paint Pigment & Rinses			
Oil	Facility Machines/Vehicles	Liquid	6 gallons/mo.
Contaminated Rags	Clean-up	Bulk	1 pickup/wk.

4. WASTE STORAGE

Type of Waste	Storage	Quantity	Length of Storage	Cost
* Thinner Components (listed above)	drum	55 gallons	6 months	0
Paint pigment	drum	55 gallons	6 months	0
* Workers deposit all wastes into one 55 gallon drum, & excluding oil wastes.				
Oil	cans	5 gallons	1 month	0

I.D. No. ____________

5. ON-SITE TREATMENT

Type of Waste	Treatment	Frequency	End Products (Quantity)	Cost
None				

6. OFF-SITE TREATMENT

	Type of Waste	Quantity % of 55gallon drum	Treatment	Who/ Where	Frequency	Cost
Thinner Components	Acetone	30-20%	sent to recycler	Oil & Solvent Process Corp.	55gallons/ 6 months	* included i unit cost
	Ketone	15-10%				
	Xylene	5·3%				
	Petroleum Naptha	25-15%				
	Isopropyl Alcohol	15-10%				
	Methanol	4·2%				
	Paint Pigment & Rinses (Balance)					
	Contaminated Rags	Varies	Laundry / Reuse	Continental Uniform	Once/wk	unknown
	Oil	5 gallons	Recycle	Service Station	1 month	0

I.D. No. ____________.

7. WASTE DISPOSAL

Type of Waste	Method of Disposal	Where	Quantity	Frequency	Cost
Paint Cans	Dumpster	On-site	Varies	Each Week	0

8. WASTE TRANSPORT

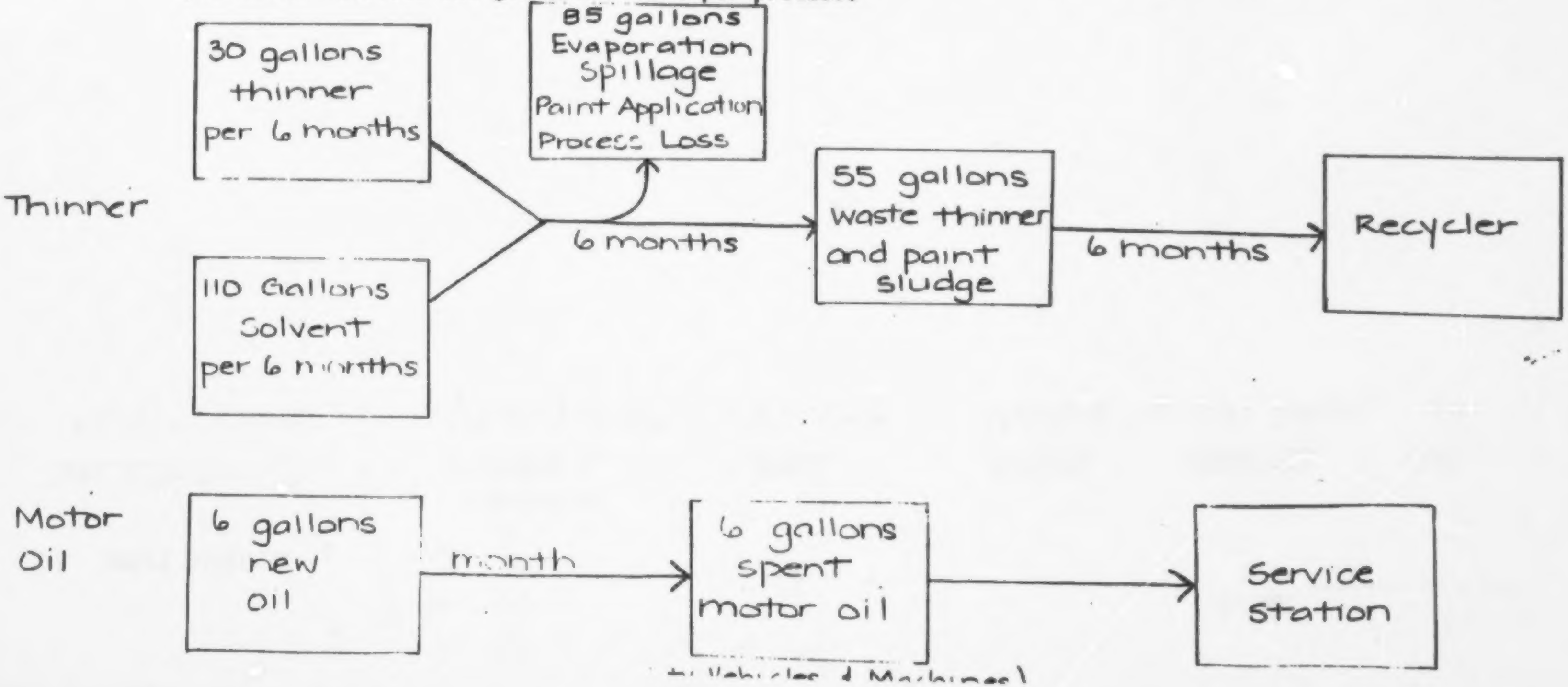
Type of Waste	Method of Disposal	Who	Quantity	Frequency	Cost
Thinner Components	Recycler	Grow Chemical Coatings Corp.	55 gallons	6 months	* included ir unit cost.
Oil	Recycle - service Station	Friend	6 gallons	1 month	0

I.D. No. ____________

9. **Does company have an existing waste minimization plan? If yes, describe.**

Parts Cleaner - SDI Parts Washer - designed for mineral spirits.
- 16 gallon tank capacity (10 gal - solvent, 2 gal - H_2O)
- disposal of spent liquid / sludge
  - unknown, system just installed

10. **Provide a waste stream schematic with a material balance. Describe the processes using chemicals. What kind are used? Usage rate? Describe the processes generating wastes. What kinds of wastes are generated? Include the generation rate per process.**


Thinner
30 gallons thinner per 6 months
110 Gallons Solvent per 6 months
85 gallons Evaporation Spillage Paint Application Process Loss
6 months
55 gallons waste thinner and paint sludge
6 months
Recycler
Motor Oil
6 gallons new oil
month
6 gallons spent motor oil
Vehicles & Machines)
Service Station

HAZARDOUS WASTE AUDIT QUESTIONNAIRE

I.D. No. B

1. GENERAL INFORMATION

Company Name:

Company Address:

Company Phone:

Contact:

Type of Business: Auto/Body & Painting

Principal Product(s): Auto/Body/Fender Repair, frame adjustment, front and rear suspension

Other ~~Products~~: alignments, collision repair & painting

no mechanical services offered

Volume of Business: ≈100 cars per month

SIC Code(s): 7531

Number of Employees: 13 full-time employees

2. CHEMICALS USED

* In the past, costs were combined as unit price which included new materials, transport & treatment.

Chemical	Use	Quantity Stored	Usage Rate	Cost
High Grade Thinner	Painting	30-55 gallons	20-25 gal/mo.	$7.60/gal *
Lacquer Thinner	Painting/Clean-up	30-55 gallons	35 gal/mo.	$3.70/gal *
Enamel Reducer	Painting	5 gallons	3 gal/mo.	Unknown
Iso-Cyanate	Hardener - Painting	2 pints	1 pt/mo.	Unknown
Catalyst	Painting	1 pint	1 pt/mo.	Unknown
Fiberglass Resin	Painting/Body Repair	1 pint	1 pt./mo.	Unknown

I.D. No. ____________

3. HAZARDOUS WASTE GENERATED

Type of Waste	Source	Physical State	Generation Rate
Thinners and painting associated compounds	Painting / Clean-up	Liquid / sludge	*

* This Was the past practice. Have recently installed Resolv-R distiller to reduce amounts of waste generated.

4. WASTE STORAGE

Type of Waste	Storage	Quantity	Length of Storage	Cost
Past Operations				
Thinners & other combined chemicals	55 gallon drum	30-55 gallons	1 1/2 months	⊖
Current Operations - implamented in past 2 months				
Thinner & other combined chemicals	55 gallon drum	Varies ⟶	Resolv - R	*

* Capital Expenditure for equipment / installation ≈ $ 2295.00

I.D. No. ____________

5. ON-SITE TREATMENT

Type of Waste	Treatment	Frequency	End Products (Quantity)	Cost
Thinner & Paint Wastes	Distiller – Recycle Resolv-R	As necessary 5 gal / cycle	Wash Thinner Base Coat Thinner] 4½ gal. Paint sludge ½ gal	Start-up cost $ 2295.

6. OFF-SITE TREATMENT

Type of Waste	Quantity	Treatment	Who/ Where	Frequency	Cost
Past Operations:					
Thinner & associated Paint Wastes	55 gallons	Recycle	Thompson Lacquer	2 months	* included in unit cost
Current Operations: May have to dispose of paint sludge from Resolv-R					
Contaminated Rags	175	Laundry / Reuse	Red star	Weekly	Unknown

I.D. No. ____________

7. WASTE DISPOSAL

Type of Waste	Method of Disposal	Where	Quantity	Frequency	Cost
Paint Cans	Dumpster	On-Site	Varies (1-2)	weekly	0
Paint Booth Filters	Dumpster	On-Site	2	6 months	0

8. WASTE TRANSPORT

Type of Waste	Method of Disposal	Who	Quantity	Frequency	Cost
Past Operations:					
Thinner / Paint Waste	Recycler	Grow Chemical Coatings	55 gallons	2 months	#35 /drum

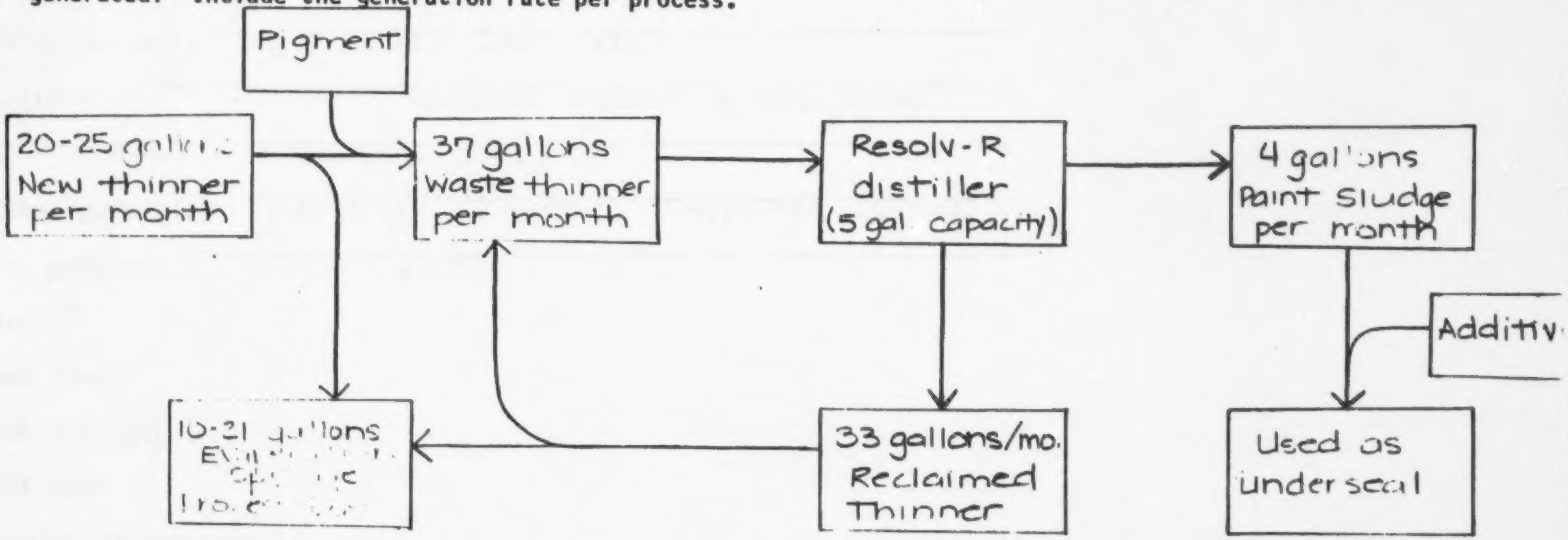
I.D. No. ______________

9. Does company have an existing waste minimization plan? If yes, describe.

Yes, Resolv - R distiller

See section # 5 - On-site Treatment.

10. Provide a waste stream schematic with a material balance. Describe the processes using chemicals. What kind are used? Usage rate? Describe the processes generating wastes. What kinds of wastes are generated? Include the generation rate per process.


Pigment
20-25 gallons New thinner per month
37 gallons waste thinner per month
Resolv - R distiller (5 gal capacity)
4 gallons Paint Sludge per month
Additiv
Used as underseal
33 gallons/mo. Reclaimed Thinner
10-21 gallons Ev[illegible] [illegible] Pro[illegible]

HAZARDOUS WASTE AUDIT QUESTIONNAIRE

I.D. No. C

1. GENERAL INFORMATION

Company Name:

Company Address:

Company Phone:

Contact:

Type of Business: Auto / Body

Principal Product(s): Provide complete collision repair - body shop - painting, welding.

Other Products: same, engine repair / service

Volume of Business: 55 cars per month

SIC Code(s): 7531

Number of Employees: 13 full-time

2. CHEMICALS USED

* Costs are combined as unit price which includes - cost of new materials, transport and treatment.

Chemical	Use	Quantity Stored	Usage Rate	Cost
Acrylic Lacquer Thinner	clean-up - painting	55 gallon drum	2 mo.	$4.40 / gal *
Solvent	parts clean-up	55 gallon drum	2gal/mo.	$ 3.00/gal *
Oil	engine repair	55 gallon drum	7gal/mo.	$ 3.75/gal
Transmission Fluid	trans. repair	55 gallon drum	1 gal/mo.	$ 3.60 /gal
Acrylic Enamel Paint	painting	about 100 qts.	varies	Varies
Brake / Hydraulic Fluid	engine repair	10 gallon drum	1 gal/mo	unknown
Antifreeze	Engine Repair	2 1/2 gallon cans	9 gal/mo.	unknown

I.D. No. ____________

3. HAZARDOUS WASTE GENERATED

Type of Waste	Source	Physical State	Generation Rate
Thinner w/ Paint Wastes	Body/printing	liquid/sludge	20 gal/mo.
Solvent	parts clean-up	liquid	2 gal/mo.
Oil	engine repair	liquid	7 gal/mo.
Transmission fluid	engine repair	liquid	1 gal/mo.
Acrylic Enamel/Paint Cans	Painting	Dried Solid Residue	Varies
Brake/Hydraulic Fluid	engine repair	Liquid	1 gal/mo.
Antifreeze	engine repair	Liquid	5 gal/mo.
Batteries	engine repair	used state	15/yr

4. WASTE STORAGE

Type of Waste	Storage	Quantity	Length of Storage	Cost
Acrylic Lacquer Thinner	55 gallon drum	1-waste drum 1-new drum thinner	2 mo.	0
Solvent	55 gallon drum	1-waste drum 1-new drum thinner	2 yrs	0
Oil	55 gallon drum	1-spent oil 1-new 55 gallon drum	1 yr	0
Transmission fluid	55 gallon drum	1-drum 55 gallons	unknown	0
Acrylic Enamel Paint	painting	about 100 quarts	varies	0
Brake/Hydraulic Fluid	drum	10 gallon	few months	0
Antifreeze	plastic containers	2½ gallons	month	0

I.D. No. ____________

5. ON-SITE TREATMENT

Type of Waste	Treatment	Frequency	End Products (Quantity)	Cost
Thinner	Decant	Daily	Sludge/Solvent	0

6. OFF-SITE TREATMENT

Type of Waste	Quantity	Treatment	Who/ Where	Frequency	Cost
Acrylic Locquer Thinner	1/9/86 - 32 gal 3/4/86 - 22 gal 5/20/86 · 52 gal	Reclamation	PCL (Pacific Coast Lacquer)	2 mo	* Included in unit cost
Solvent	55 gallons	Recycler	Leach Oil Co.	1/yr.	* Included in unit cost
Waste Oil	84 gallons	Recycler	Leach Oil Co.		<.50¢/gal>
Contaminated Rags	varies	laundry/reuse	Angelica Laundry	1/wk.	unknown

I.D. No. ____________

7. WASTE DISPOSAL

Type of Waste	Method of Disposal	Where	Quantity	Frequency	Cost
Batteries	Salvage	unknown	4-5	4mo.	0
Soil	IT-haulers	BKK	8-10, 55 gallon drums	Once	unknown
Paint Cans	Dumpster	Facility	Varies/Unknown	Weekly	0

8. WASTE TRANSPORT

Type of Waste	Method of Disposal	Who	Quantity	Frequency	Cost
Acrylic Lacquer Thinner	Recycler	Pacific Coast Lacquer	Varies 22-52 gallons	2 mo.	* included in unit cost
Oil	Recycler	Leach Oil Co.	50 gallons	6 mo.	0

I.D. No. ____________

9. Does company have an existing waste minimization plan? If yes, describe.

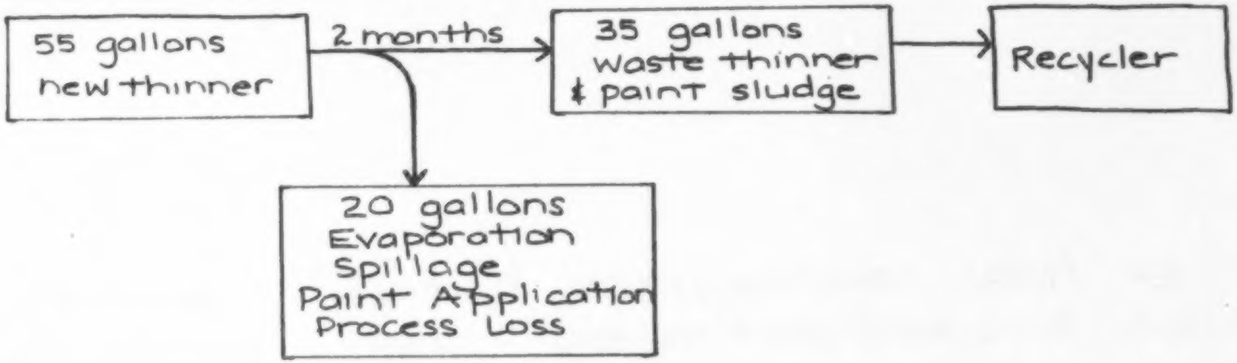
Recycle solvent (parts washing)
- drain liquid for reuse
- clean out sludge

Thinner
- once through - no reuse

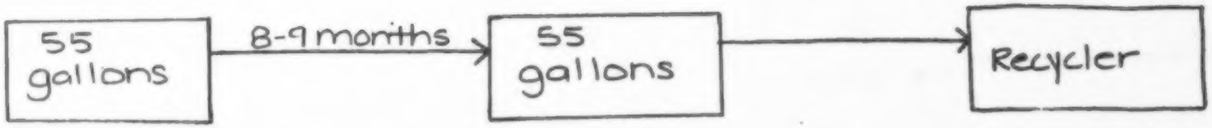
Clarifier -
- waste water intercepted at M.C. Nottingham clarifier
- pumped yearly - $400 gallons / 7 months

10. Provide a waste stream schematic with a material balance. Describe the processes using chemicals. What kind are used? Usage rate? Describe the processes generating wastes. What kinds of wastes are generated? Include the generation rate per process.

Thinner


55 gallons new thinner
2 months
35 gallons waste thinner & paint sludge
Recycler
20 gallons
Evaporation
Spillage
Paint Application
Process Loss

Oil


55 gallons
8-9 months
55 gallons
Recycler

HAZARDOUS WASTE AUDIT QUESTIONNAIRE

I.D. No. D

1. GENERAL INFORMATION

Company Name:

Company Address:

Company Phone:

Contact: _

Type of Business: Auto / Body - Painting

Principal Product(s): Collision Repair, welding frame/suspension alignments, painting

Other Products: none

Volume of Business: 30-40 cars per month

SIC Code(s): 7531

Number of Employees: 9 full-time employees

2. CHEMICALS USED * Costs are combined as unit price which includes - cost of new materials, transport & treatment.

Chemical	Use	Quantity Stored	Usage Rate	Cost
High Grade Thinner	Painting	15 gallons	7 gal/mo.	$6/gallon *
Lacquer Thinner	Painting / Clean-up	55 gallons	30 gal/mo.	
Enamel Reducer	Painting	5 gallons	5 gal/mo.	unknown
Motor Oil	Facility Vehicle Maintenance only	12 cans	1-2 gal/mo.	.55¢/qt

I.D. No. ____________

3. HAZARDOUS WASTE GENERATED

Type of Waste	Source	Physical State	Generation Rate
Thinners plus Reducer	Painting/Clean-up	Liquid/sludge	30gal/mo.
Filters	Paint Booth	Styrofoam	2 per 3 mo.
Oil	Facility Vehicles	Liquid	1-2 gal/mo.

4. WASTE STORAGE

Type of Waste	Storage	Quantity	Length of Storage	Cost
Thinner	55 gallon drum	15-18 gallons	14 day cycle	0

I.D. No. ____________

5. ON-SITE TREATMENT

Type of Waste	Treatment	Frequency	End Products (Quantity)	Cost
None				

6. OFF-SITE TREATMENT Pacific Coast Lacquer - Closed Loop System

Type of Waste	Quantity	Treatment	Who/ Where	Frequency	Cost
Thinners / Paint	15-18 gallons	Recycle	Pacific Coast Lacquer	14 day cycle	* Included in unit cost
Filters	2.	Dissolve into Thinner Waste	PCL	3 months	0

I.D. No. ____________

7. WASTE DISPOSAL

Type of Waste	Method of Disposal	Where	Quantity	Frequency	Cost
Paint Pigment Cans	Dumpster	On-site	Varies	weekly	0
Used Motor Oil	Service Station	Down street	5gal	6 months	0

8. WASTE TRANSPORT

Type of Waste	Method of Disposal	Who	Quantity	Frequency	Cost
Thinner/ Paint Waste	Recycler	*Pacific Coast Lacquer	15-18 gallons	14 days	* included in unit cost

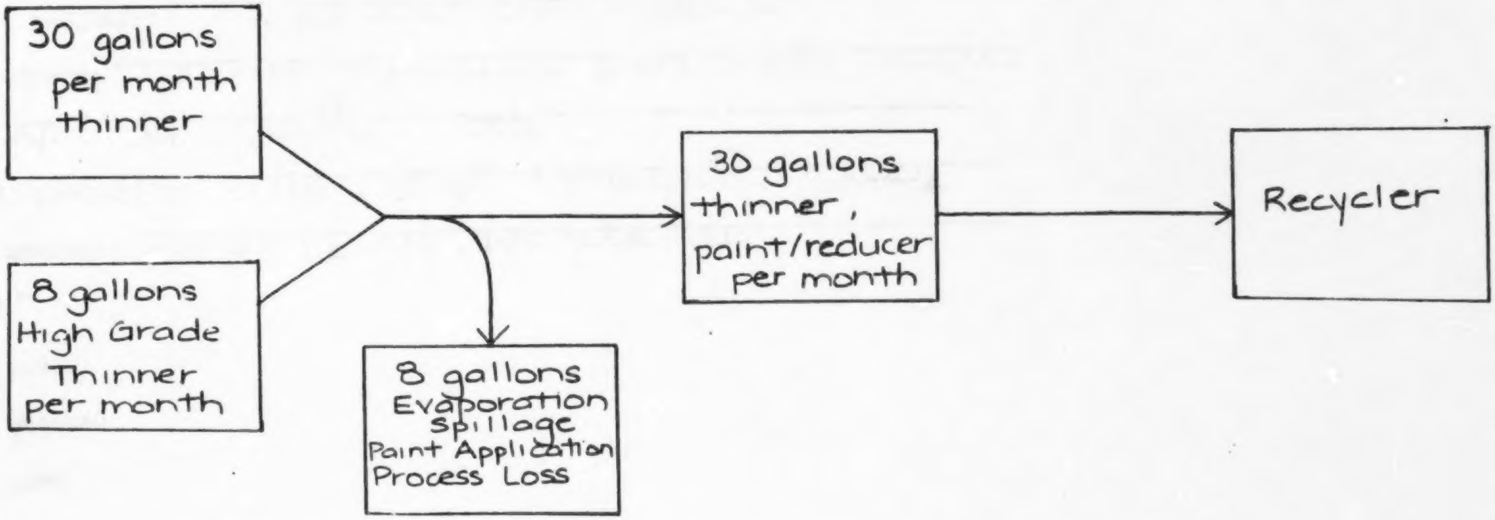
* Has been on PCL system for three months.

I.D. No. ____________

9. Does company have an existing waste minimization plan? If yes, describe.

No

10. Provide a waste stream schematic with a material balance. Describe the processes using chemicals. What kind are used? Usage rate? Describe the processes generating wastes. What kinds of wastes are generated? Include the generation rate per process.


30 gallons per month thinner
8 gallons High Grade Thinner per month
8 gallons Evaporation Spillage Paint Application Process Loss
30 gallons thinner, paint/reducer per month
Recycler

HAZARDOUS WASTE AUDIT QUESTIONNAIRE

I.D. No. E

1. GENERAL INFORMATION

Company Name:

Company Address:

Company Phone:

Contact: _

Type of Business: Auto / Body / Mechanical

Principal Product(s): Auto / Body , Painting , Front Ends , Oil changes , ect.

Other Products: Do not advertise mechanical services

Volume of Business: ≈ 30 cars per month

SIC Code(s): 7533

Number of Employees: 7 full time employees

2. CHEMICALS USED

* Costs are combined as unit price which includes - cost of new material, transport and treatment.

Chemical	Use	Quantity Stored	Usage Rate	Cost
Thinners	Cleaning / Painting	55 gallons	3 months	$6.60 / gal *
Oil	Mechanical / Engine	55 gallons	4-5 months	.55¢ / qt
Bondo	Collision Repair	4 gallons	1 month	unknown
Antifreeze	Mechanical / Engine	4 gallons	1 month	unknown
Paints	Auto / Body	≈ 40 quarts 50 pints some gallons	Varies	$15-80 / quart

I.D. No. ____________

3. HAZARDOUS WASTE GENERATED

Type of Waste	Source	Physical State	Generation Rate
Thinner & Paint Wastes	Cleaning / Painting	Liquid / sludge	16 gal / mo
Oil	Engine Repair	Liquid	14 gal / mo
Paint Cans	Auto / Body	Cans w/ Residue	Varies
Antifreeze	Broken Radiators	Liquid	1-2 gal / mo.
Contaminated Rags	Cleaning	Saturated Rags	1 load / wk
Bondo	Body Repairs	Dust	Unknown

4. WASTE STORAGE

Type of Waste	Storage	Quantity	Length of Storage	Cost
Thinner & Paint Wastes	drums	55 gallons	3 months	0
Oil	drum	55 gallon	4-5 months	0
* Antifreeze			* Radiators are often damaged on arrival & liquid usually drains on floor.	0

I.D. No. ______________

5. ON-SITE TREATMENT

Type of Waste	Treatment	Frequency	End Products (Quantity)	Cost
None				

6. OFF-SITE TREATMENT

Type of Waste	Quantity	Treatment	Who/ Where	Frequency	Cost
Thinner & Paint Waste	55 gallon	Recycle	Oil & Solvent Process Co.	once/3 months	* included in unit cost
Oil	55 gallon	Recycle	Leach Oil	once/4-5 months	$10/55 gal
Contaminated Rags	≈ 200	Laundry/Reuse	Welchs Uniforms	once / wk	$40/wk

I.D. No. ____________

7. WASTE DISPOSAL

Type of Waste	Method of Disposal	Where	Quantity	Frequency	Cost
Paint Cans	Dumpster	On-site	Varies	Weekly	0

8. WASTE TRANSPORT

Type of Waste	Method of Disposal	Who	Quantity	Frequency	Cost
Paint Waste & Thinners	Recycler	* A & H paint contacts Grow chemical coatings Corp.	55 gallons	3 months	* included in unit cost
Oil	Recycler	Leach Oil	55 gallons	4-5 months	* included in unit cost

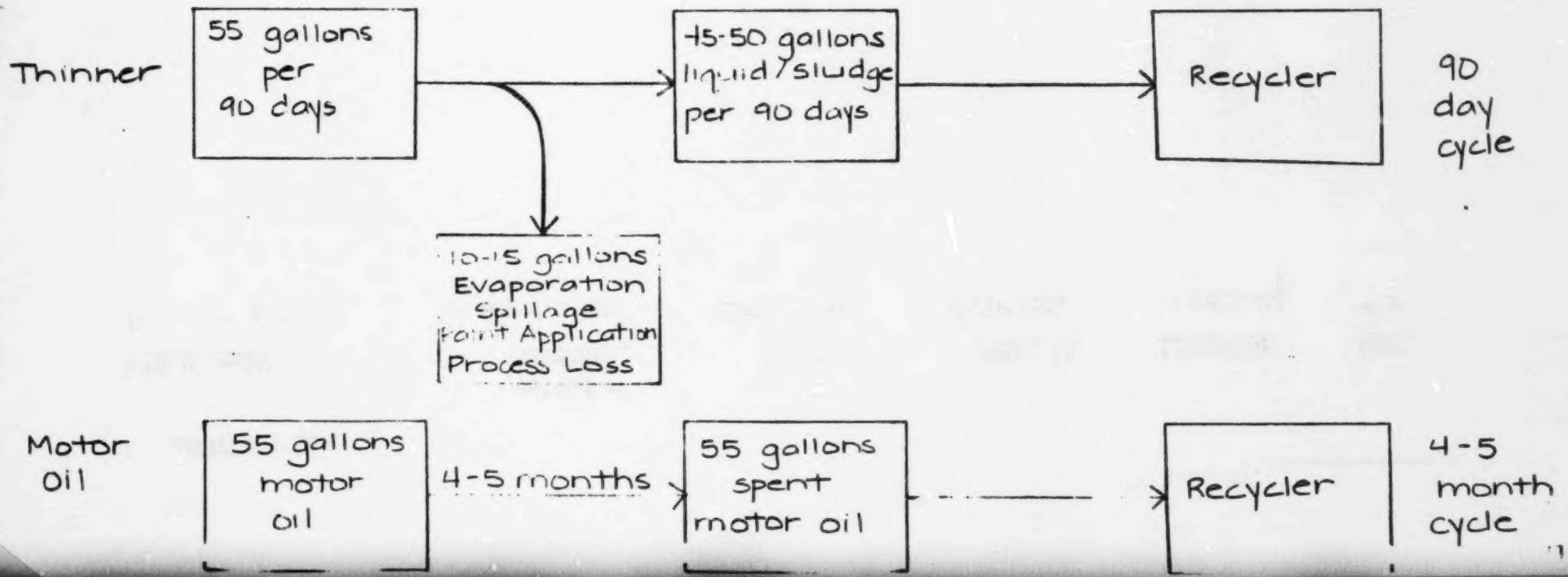
* Paint & Solvent Supplier

I.D. No. ____________

9. Does company have an existing waste minimization plan? If yes, describe.

None

10. Provide a waste stream schematic with a material balance. Describe the processes using chemicals. What kind are used? Usage rate? Describe the processes generating wastes. What kinds of wastes are generated? Include the generation rate per process.


Thinner
55 gallons per 90 days
45-50 gallons liquid/sludge per 90 days
Recycler
90 day cycle
10-15 gallons
Evaporation
Spillage
Paint Application
Process Loss
Motor Oil
55 gallons motor oil
4-5 months
55 gallons spent motor oil
Recycler
4-5 month cycle

HAZARDOUS WASTE AUDIT QUESTIONNAIRE

I.D. No. F

1. GENERAL INFORMATION

Company Name:

Company Address:

Company Phone:

Contact: _

Type of Business: Auto / Body repair and Painting

Principal Product(s): Collision repair, painting - no vehicle maintenance offered on-site.

Other Products: same

Volume of Business: 25 cars per month

SIC Code(s): 7531

Number of Employees: 3 full-time employees

2. CHEMICALS USED

* Costs are combined as a unit price which includes - cost of new materials, transport & treatment.

Chemical	Use	Quantity Stored	Usage Rate	Cost
High Grade Thinner	Painting	15 gallons	1-2 gal/mo.	$8/gal *
Lacquer Thinner	Painting / Clean-up	55 gallons	5-10 gal/mo.	$4.40/gal *
Enamel Reducer	Painting	5 gallons	2 gal/mo.	Unknown
Enamel Catalyst	Painting	1-2 quarts	1-2 qts/wk (varies)	Unknown

I.D. No. ____________

3. HAZARDOUS WASTE GENERATED

Type of Waste	Source	Physical State	Generation Rate
Thinners & Catalyst & Reducer	Painting	Liquid / sludge	5 gal / mo
Paint Booth Filters	Paint Booth	Material w/ Paint Residues	2 filters/6 mo.
Paint Leftovers	Painting	Partially Full Cans	Unknown
Gallon Cans	Reducer / Catalyst	Empty Can	Unknown

4. WASTE STORAGE

- well marked outdoor storage locker, metal bottom w/ ground

Type of Waste	Storage	Quantity	Length of Storage	Cost
Thinner, Reducer & Catalyst	55 gallon drum	5-18 gallons	90 days	0
Paints in Mixing Area	Partially Full Quart Cans	≈ 50	Rotating	0

I.D. No. ____________

5. ON-SITE TREATMENT

Type of Waste	Treatment	Frequency	End Products (Quantity)	Cost
None				

6. OFF-SITE TREATMENT

Type of Waste	Quantity	Treatment	Who/ Where	Frequency	Cost
Thinners w/ Paint, Reducer, Catalyst	10-18 gallons	Recycle	PCL (Closed Waste system)	90 days	* unit cost
Contaminated Rags	150	Laundry / Reuse	unknown	month	unknown

I.D. No. ____________

7. WASTE DISPOSAL

Type of Waste	Method of Disposal	Where	Quantity	Frequency	Cost
Paint cans w/residue	Give to customer for touch-ups	Unknown	1-8 oz /car	25/mo	0
Paint Filters	Dumpster	On-site	2	6mo	0
Gallon Cans	Use in shop Give to striper	Unknown	2-3	month	0

8. WASTE TRANSPORT

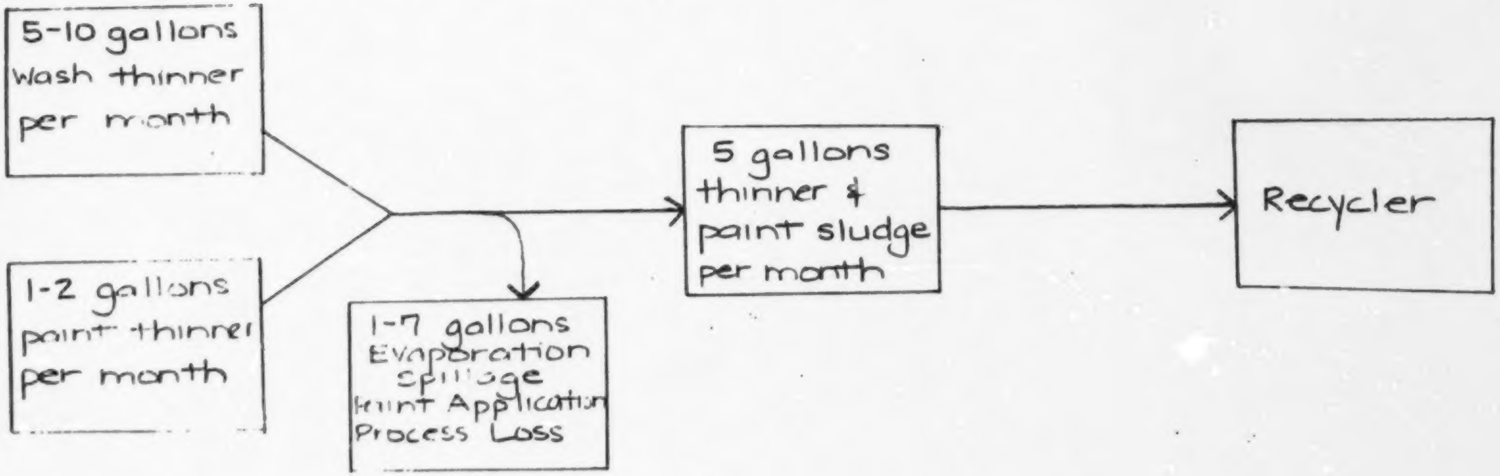
Type of Waste	Method of Disposal	Who	Quantity	Frequency	Cost
Thinner w/ associated components	Recycler	Pacific Coast Lacquer	10-18 gallons	90 days	* include in Unit cost

I.D. No. ____________

9. **Does company have an existing waste minimization plan? If yes, describe.**

Rigid Inventory control by owner/painter.
Reuse of spent solvents for equipment/parts cleon-up

10. **Provide a waste stream schematic with a material balance. Describe the processes using chemicals. What kind are used? Usage rate? Describe the processes generating wastes. What kinds of wastes are generated? Include the generation rate per process.**


5-10 gallons Wash thinner per month
1-2 gallons paint thinner per month
1-7 gallons Evaporation Spillage Paint Application Process Loss
5 gallons thinner & paint sludge per month
Recycler